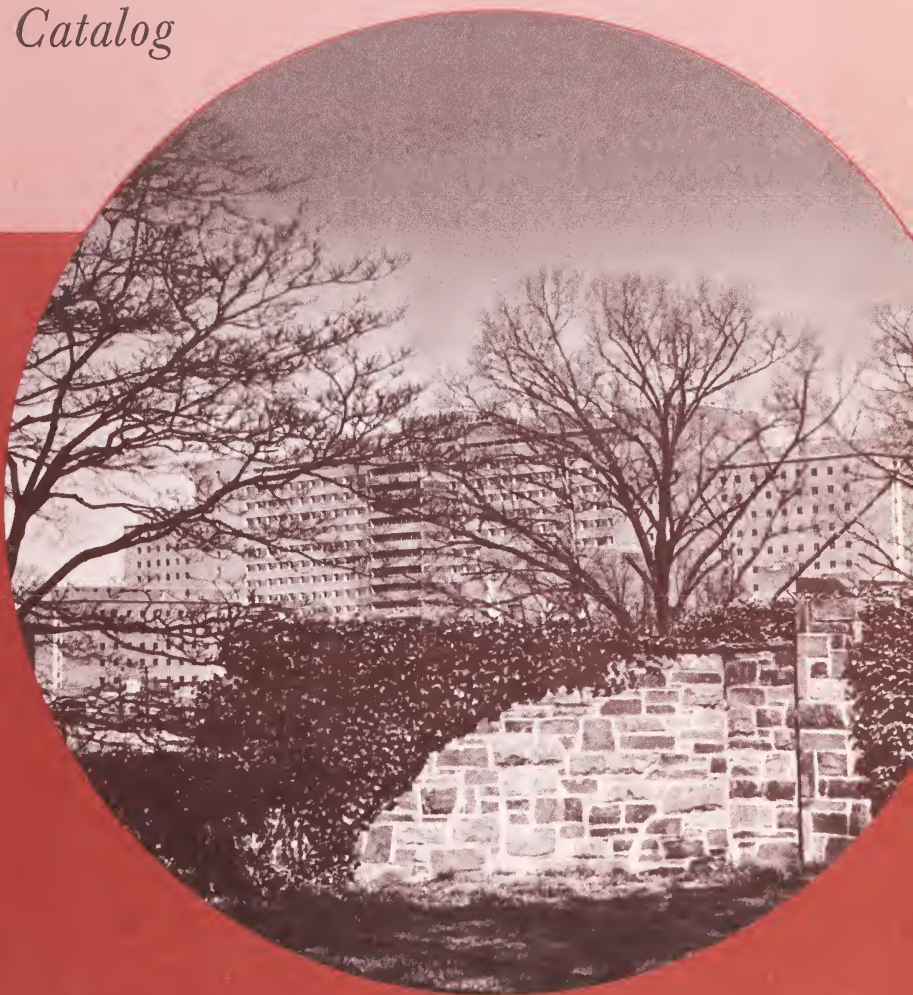


Associate Training Programs in the Medical and Biological Sciences

at the NATIONAL INSTITUTES OF HEALTH

1968 Catalog



DISCRIMINATION PROHIBITED

Title VI of the Civil Rights Act of 1964 states: "No person in the United State shall, on the ground of race, color, or national origin, be excluded from participation in, be denied the benefits of, or be subjected to discrimination under any program or activity receiving Federal financial assistance." Therefore, the Associate Training Programs in the Medical and Biological Sciences at the National Institutes of Health, like every program or activity receiving financial assistance from the Department of Health, Education, and Welfare, must be operated in compliance with this law.

1968

SCHEDULE FOR APPOINTMENTS BEGINNING JULY 1, 1970

April 19

Deadline for receipt at NIH of completed applications.

June 10 to 28

Interview period at NIH campus, Bethesda, Maryland (by invitation only).

July 15

Notification of all applicants begins.

The National Institutes of Health conducts and supports research to find better ways of preventing or curing disease and lengthening life. In pursuit of that mission, NIH provides broad support for biomedical research, research training, and construction of research facilities in the Nation's medical and dental schools, universities, and other research centers. This is the NIH extramural program.

FOREWORD

NIH conducts laboratory and clinical research in its own facilities on its 306-acre campus in Bethesda, Md. For example, in the past year, over 4,000 patients were admitted for investigative studies in the Clinical Center—a research hospital with 516 patient beds and 1,100 laboratories. At any point in time, more than 1,400 research projects are in progress here on the Bethesda campus and at field offices directed from here. This is the NIH intramural program.

Of the 1,800 NIH staff members with doctorates, almost 1,000 have M.D. degrees, 700 have Ph. D. degrees, and some have both. Fifty are dentists, 40 are veterinarians. These individuals with their 3,600 scientifically trained assistants, represent most of the disciplines that contribute to new medical knowledge.

In this scientific community, many opportunities for professional development are available to physicians and others who are undertaking careers in medical or related research, or in academic medicine. The purpose of this catalog is to set forth in one place brief descriptions of programs of concern to those interested in Associateships at the NIH.

ROGER L. BLACK, M.D.,
Associate Director, Clinical Center
Chief, Clinical and Professional
Education.

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PART ONE

General Characteristics of Associateships

UNUSUAL opportunities for training and experience in clinical and laboratory investigation are available to physicians and dentists who receive appointments as Clinical, Research, and Staff Associates at the National Institutes of Health. These positions provide broad opportunities for career development in most of the medical specialties and basic science disciplines.

Physicians who are entering internship on or before July 1, 1968, or those with more advanced training may apply. Selections are usually made 2 years in advance, and successful candidates are considered for residency training deferment (usually 1 year) through the PHS CORD Program until their effective date of appointment.

Although appointments are not limited to those who qualify for the Commissioned Corps of the PHS, most Associates enter NIH as commissioned officers. For young men who have not fulfilled their military obligation under Selective Service, this obligation can be discharged as Commissioned Officers of the PHS. The residency deferment program and the responsibilities of a PHS officer are explained in Part Two of this publication.

Appointees are designated as Clinical Associates, Research Associates, and Staff Associates. Appointments in pharmacology are also offered by the National Institute of General Medical Sciences (see pages 3 and 41 for further details). Each Associate is assigned to a preceptor under whose direction he participates in a research program. This represents the most important part of his training experience.

The preceptors are staff members who give generously of their time to help the Associate—not only in relation to research problems under investigation, but in any way they can to enrich the experience of the Associate during his stay at NIH. The levels of research responsibility and latitude given to an Associate depend upon his training and experience as well as his interests and initiative.

Separate didactic exercises are designed to complement Clinical and Research Associateships, but Associates in all three categories are welcome to attend any of the exercises which can accommodate them if their schedules permit. In addition, postgraduate instruction is available through evening courses offered by the Foundation for Advanced Education in the Sciences, Inc. (see Part Four), and Associates in many program areas are expected to take advantage of this academic opportunity.

Associateship appointments are generally made for 2 years; in certain Institutes, appointments may be extended for an additional year. Unless he seeks transfer to another area of the Public Health Service, an Associate may expect to end his active duty as an officer at the completion of his Associateship appointment.

The Clinical Associate

The Clinical Associate participates in both clinical and laboratory research. Institute programs differ in the proportion of time devoted to laboratory and clinical responsibilities.

Ward activities are under immediate supervision of competent clinical investigators, and include a wide variety of rounds, conferences, and other instructive exercises. Proximity to the patient's bedside of collaborating scientists from many biological disciplines has created an unusual opportunity for clinical investigation at the NIH Clinical Center.

The great majority of Clinical Associates are not in formal residency training programs, even though they may be performing many of the same functions that residents do in other hospitals. Some Associates appointed to Dermatology, Neurology, and Psychiatry programs are recommended for a limited amount of residency credit by their respective program chiefs. Associates in positions providing further training in Internal Medicine who remain at NIH for a third year may receive credit for this year upon application to the American Board of Internal Medicine.

The Research Associate

The Research Associate devotes the larger portion of his time to laboratory research in the biomedical sciences. His preceptor is responsible for training him in research methodology and design, and for guiding him in the conduct of specific research undertakings and in the interpretation of results. A real effort is made to select research problems which will enable the Associate to gain breadth and perspective, encounter a variety of laboratory problems, and learn many different approaches rather than become a specialist in one or two refined techniques.

In addition, the Research Associate participates in a series of formal tutorial seminars and informal discussion groups designed in content and emphasis for prospective independent investigators. This program is designed to furnish the training in basic medical sciences normally received by Ph. D. candidates but not generally by candidates for the M.D. degree. As described later (see Part Four, Seminars), these discussions are arranged in five divisions, each of which deals with one of the major subdivisions of research in the life sciences.

The Pharmacology Research Associate

Through an expansion of the NIH Associate Training Program, the National Institutes of Health is increasing its commitment to develop scientific manpower for both basic and applied research in pharmacology and closely related areas of biomedical science.

The Pharmacology Research Associate devotes the larger portion of his time to laboratory research. He receives intensive research training in a number of disciplines related to modern pharmacology. He also attends formal teaching seminars and informal discussion groups which will provide him with the opportunity to master selected topics perhaps not adequately covered during his academic training.

The Staff Associate

The Staff Associate position provides opportunities for those highly qualified candidates who could contribute significantly to research in areas which are not specifically designated in the Research or Clinical Associate categories. The Staff Associate may participate in either laboratory or clinical research or both, depending upon the activities of the senior investigator with whom he works. Research experience may be supplemented by formal evening study courses, as well as by attendance at lectures by guest speakers and a variety of regularly scheduled seminars.

PART TWO

Applying for an Associateship

APPROXIMATELY 100 Clinical Associates and 50 Research and Staff Associates are appointed annually, usually as commissioned officers. In special cases, appointment may be considered under the Civil Service mechanism. Of course, in such instances, the following statements relating to the PHS Commissioned Corps, the commissioning process and the CORD Program would not apply.

To be considered for a Clinical, Research, or Staff Associate appointment, an applicant must submit the following forms properly executed no later than April 19, 1968 to the Chief, Clinical and Professional Education, National Institutes of Health, Bethesda, Md. 20014:

- Information Record for Clinical, Research, and Staff Associate positions;
- Program Area Selection Check List;
- NIH Associate Information and Status Record;
- Interview Information Record;
- Application for Appointment as a Commissioned Officer in the U.S. Public Health Service (2 copies);
- Fingerprint chart (fingerprints may be obtained at PHS facilities or through the local police or post office).

The applicant is responsible for requesting the following materials, which must be received by April 19 to complete the application:

- Three sets of references from professional persons whom the candidate has listed on the NIH information sheet (each set consists of: 1. Request for confidential evaluation of applicant for appointment as an NIH Associate; and 2. Statement regarding applicant for a commission in the U.S. Public Health Service).
- Two copies of all college and medical school transcripts (showing class standing, if available).

A candidate's application for a commission in the Public Health Service does not commit him to accept a commission in the event he is not selected for an Associate position at NIH. However, there are many splendid alternative opportunities for physicians in the Public Health Service which may appeal to such a candidate, and this commission application would be usable for such appointments.

Eligibility Requirements

To qualify for a commission, an applicant must:

- Be a citizen of the United States;
- Meet the physical standards of the Public Health Service (a physical examination is given at a PHS facility) ; and
- Pass an objective multiple-choice examination administered by the PHS and covering the general field of medicine.

In addition, to be considered for CORD Program participation, an applicant must:

- Be a graduate of a medical school approved by the Council on Medical Education of the American Medical Association.
- Be currently interning or have completed an internship approved by the Council on Medical Education of the American Medical Association.
- Be liable for 2 years of service under the general provisions of the Universal Military Training and Service Act.

NOTE: Even though tentatively selected for an Associateship at NIH, an applicant cannot participate in the CORD Program unless also found fully qualified for appointment as a commissioned officer and will pursue *clinical* training which is fully creditable toward fulfillment of minimum residency requirements for certification by an American medical specialty board.

Commissioned Officer Residency Deferment Program

The Commissioned Officer Residency Deferment Program (CORD), developed and conducted by the U.S. Public Health Service with the cooperation of the Selective Service System, permits a limited number of draft-eligible physicians (1) to become Inactive Reserve officers in the Commissioned Corps of the Public Health Service and (2) to complete 1 or more years of formal residency training before serving on active duty.

In this program, selected physicians who are obligated for 2 years of military service under the general provisions of the Universal Military Training and Service Act are deferred by the Director of the Selective Service System for residency training in specialties that are pertinent to the projected requirements of the Public Health Service.

CORD Program participants are appointed commissioned officers in the Inactive Reserve of the Public Health Service. They do not receive pay from the Service until called to active duty. The stipend normally paid by the hospital to residents may be accepted by CORD Program officers.

When residency training is completed and/or deferment is terminated, the CORD Program officer is obligated to serve on active duty with the Public Health Service for a period of at least 24 months. This period of service will satisfy Selective Service obligations and no further service is required.

It should be noted that, even though tentatively selected for the CORD Program, an applicant cannot participate unless also found fully qualified for appointment as a commissioned officer.

The questions most frequently asked by CORD Program applicants and participants are answered below:

Q. May I apply simultaneously for the Berry and CORD Programs?

A. Yes.

Q. As an intern in a USPHS hospital (or other uniformed service hospital), am I eligible for the CORD program?

A. If you are interning as a commissioned officer on active duty in the Army, Navy, Air Force, or Public Health Service, you are not eligible to participate in the CORD Program.

Q. Are participants in the Senior Medical Student Program of the Army (or other service) eligible for the CORD Program?

A. No.

Q. As a CORD participant, may I be deferred for a research fellowship?

A. No. Deferment may not be recommended for periods of basic science or other graduate training unless the academic training is an integral

part of a clinical residency program. Such training must be fully creditable toward fulfillment of minimum residency training requirements for certification by an American medical specialty board.

- Q. I wish to continue my residency training and have applied for the CORD Program. Will the induction notice I recently received from my local Selective Service board alter my status as a CORD Program applicant?
- A. Yes. You are no longer eligible for CORD Program consideration, unless the induction notice is canceled. "Postponement of induction" will not reestablish your eligibility.
- Q. Is there an age limit for the CORD Program?
- A. Yes. You must complete CORD Program participation and begin active duty before age 32.
- Q. If I am not successful in seeking an NIH Associateship, may I still participate in the CORD Program?
- A. Yes. If you apply and are not accepted for an NIH Associate assignment, you may elect (1) to withdraw your application for the CORD Program, or (2) to be considered for residency deferment under the CORD Program and subsequent active duty in one of the other activities of the Public Health Service.
- Q. I have received notification of selection for CORD Program participation and deferment beginning July 1, 1969. Is it possible for my deferment to begin on February 1?
- A. No. Deferment before July 1 cannot be arranged.
- Q. I was selected for the CORD Program and residency training in surgery but have now decided I wish to train in pediatrics. May I change my specialty?
- A. No. Changes in specialty are not permitted after selections are made.
- Q. May I change hospitals while participating in the CORD Program?
- A. Yes, provided the new program is approved by the Council on Medical Education of the American Medical Association, all the training is fully creditable by your specialty board, and you notify the Public Health Service Office of Personnel.
- Q. Is it possible to withdraw from the program prior to actual deferment?
- A. Yes. You may withdraw your CORD Program application at any time prior to appointment as a commissioned officer, or, if you have already been appointed, you may resign the commission. The Selective Service will be notified of your withdrawal or resignation.
- Q. Is it possible to withdraw from the program while pursuing residency training as a CORD Program officer?
- A. Yes. You may request active duty in the Public Health Service.
- Q. For what rank am I eligible?
- A. If you enter the CORD Program immediately following internship, you will be appointed in the grade of assistant surgeon (Inactive Reserve),

which is equivalent to lieutenant (j.g.) in the Navy. When called to active duty, you receive a promotion to the grade of senior assistant surgeon (Reserve), which is equivalent to lieutenant in the Navy.

A pamphlet giving more details about the CORD Program is available on request.

Method of Selection—Matching Program

Appointments are based upon intellectual attainment and demonstrated research interest and ability. A man's background in research is often a decisive factor in making selections. This applies more significantly in certain areas—such as internal medicine and psychiatry—than in others—such as surgery and radiation therapy.

All applications are carefully considered; but it should be understood that successful candidates have outstanding records in medical school and their references indicate that they have exceptional research training and/or potential.

Associates are selected by a system of matching the candidates' program-area preferences against nominations made by the Institutes (similar to NIMP, Inc.).

In his packet of forms, a candidate will find several sheets, each headed "Program Area Selection Check List." After reading Part Three of this catalog, he should check off on these sheets the areas in which he is interested. He does not indicate his preferences at this point, and he is not limited to any particular number of choices. The check marks that he makes will determine the offices and laboratories to which his application will be circulated at the National Institutes of Health.

After thorough review of all candidates' qualifications by the Institutes, a limited number of candidates will be selected for personal interviews to be held during a 3-week period from June 10 through 28. Candidates should be prepared to come to NIH for an interview on short notice on any date within this period, at their own expense. All interviews are by invitation and will be arranged through the Chief, Clinical and Professional Education. Following interviews, candidates will be requested to indicate their preferences, which are kept in confidence and used exclusively for matching against the Institutes' nominations. Successful candidates will be notified on July 15 and succeeding days and be given an opportunity to accept or reject the positions for which they were matched.

**PART
THREE**

Program Areas for Which Candidates May Apply

EACH of the major NIH components has prepared a description of its program areas for which Associates may seek appointment. Due to diversity of the operations and programs within these major components, the descriptions do not follow a pattern. In effect, however, all of these descriptions are meant to anticipate the questions which applicants may have in selecting the program areas for which they wish to be considered. It should be noted that a candidate is not limited as to the number or kinds of positions for which he may apply.

National Cancer Institute

Director, Kenneth M. Endicott, M.D.
Clinical Director, Nathaniel I. Berlin, M.D., Ph. D.

Laboratories and Branches

Scientific Director for General Laboratories and Clinics, Eugene J. Van
Scott, M.D.

Chief, Laboratory of Biochemistry, Herbert A. Sober, Ph. D.

Chief, Laboratory of Biology, Walter E. Heston, Ph. D.
 Head, Macromolecular Biology Section, Peter T. Mora, Ph. D.
 Chief, Laboratory of Physiology, Julius White, Ph. D.
 Chief, Laboratory of Pathology and Pathologic Anatomy Branch,
 Harold L. Stewart, M.D.
 Chief, Dermatology Branch, Eugene J. Van Scott, M.D.
 Chief, Endocrine Evaluation Branch, Erwin P. Vollmer, Ph.D.
 Chief, Endocrinology Branch, Mortimer B. Lipsett, M.D.
 Chief, Immunology Branch, John L. Fahey, M.D.
 Chief, Metabolism Branch, Nathaniel I. Berlin, M.D., Ph. D.
 Chief, Surgery Branch, Alfred S. Ketcham, M.D.
 Scientific Director for Etiology, Carl G. Baker, M.D.
 Associate Scientific Director for Planning and Analysis, Vacancy.
 Associate Scientific Director for Viral Oncology, Frank J. Rauscher, Jr.,
 Ph. D.
 Chief, Viral Biology Branch, Albert J. Dalton, Ph. D.
 Chief, Viral Carcinogenesis Branch, James Duff, Ph. D., Acting.
 Chief, Viral Leukemia and Lymphoma Branch, John Moloney, Ph.D.
 Associate Scientific Director for Carcinogenesis, Hans L. Falk, Ph. D.
 Chief, Biology Branch, Herbert J. Rapp, Sc. D.
 Chief, Chemistry Branch, Harry V. Gelboin, Ph. D.
 Associate Scientific Director for Demography, Carl G. Baker, M.D.,
 Acting.
 Chief, Biometry Branch, William M. Haenszel, M.A.
 Chief, Epidemiology Branch, Robert W. Miller, M.D., Dr. P.H.
 Scientific Director for Chemotherapy, C. Gordon Zubrod, M.D.
 Chief, Medicine Branch, Seymour M. Perry, M.D.
 Chief, Radiation Branch, Ralph Johnson, M.D.
 Chief, Laboratory of Chemical Pharmacology, David P. Rall, M.D.,
 Ph. D.
 Chief, Baltimore Cancer Research Center, Jerome B. Block, M.D.
 Chief, Cancer Chemotherapy National Service Center, Saul A.
 Schepartz, Ph. D.
 Chief, Drug Development Branch, Harry B. Wood, Jr., Ph.D.
 Chief, Drug Evaluation Branch, John M. Venditti, Ph. D.
 Chief, Program Analysis Branch, Barbara R. Murray, M.A.
 Chief, Cancer Therapy Evaluation Branch, Laurence V. Foye, Jr., M.D.

General Laboratories and Clinics

A broad range of research is carried out in both basic laboratories and clinical branches under the general direction of Dr. Eugene Van Scott.

In the LABORATORY OF BIOCHEMISTRY, research is directed toward the recognition, elucidation, and control of the neoplastic transformation. To this end, the disciplines of chemistry, biochemistry, biology, and physical chemistry are used to study the composition, metabolism, structure, and function of isolated biological components. Special attention is given the

macromolecular components of the cell and their organization in intracellular organelles, whole cells, tissues, and organs, with reference to their role in differentiation and control processes.

In the **LABORATORY OF BIOLOGY**, carcinogenesis is studied in the broad biological sense. Attention is given to the manner in which genetic, hormonal, immunological, and viral factors as well as chemical and physical carcinogens lead to the malignant transformation of the cell. Studies are aimed at revealing the nature of this transformation as it occurs under well controlled conditions in tissue culture. Ultrastructure of the cells and the viruses involved are investigated. The role of the thymus in immunology and in viral and chemical carcinogenesis is receiving considerable emphasis. Studies of genetic control of synthesis of abnormal proteins produced by plasma cell tumors and of blood and urinary proteins in mice and subhuman primates are also of primary interest.

In the **MACROMOLECULAR BIOLOGY SECTION** the problems of cell differentiation and growth are approached by studying macromolecular interactions and differential synthesis of biological macromolecules. Studies include differential transcription, nucleic acid homology, translational controls, and the role of cell membranes in regulating cell proliferation.

In the **LABORATORY OF PHYSIOLOGY** there are a number of projects which deal primarily with the physiological and biochemical properties of the growing tumor and its impact on the host. Approaches to these problems are made by studies on control of protein synthesis in normal and tumor cells; the mechanisms of synthesis and secretion of hormones on thyroids and thyroid tumors; urinary excretion of purine and pyrimidine congeners and their relation to various types of leukemia; total energy expenditure of the tumor-bearing host as it is derived from both the host and the tumor; characterization and comparison of nucleic acids and nucleoproteins in bacterial and mammalian tissues, with particular emphasis on elucidating the enzymatic control mechanisms generating in the intact cell; mechanism of repair and recovery of sublethally damaged cells exposed to ionizing radiation; effect of ionizing irradiation on enzyme systems which entails the partial and complete destruction of active centers; antibody formation following multiple irradiation and immunization procedures; radiation damage and recovery of the hematopoietic system.

In the **LABORATORY OF PATHOLOGY** and the **PATHOLOGIC ANATOMY BRANCH**, normal and malignant tissues are examined and compared. The spontaneous development of cancer in untreated laboratory animals is observed to arrive at a better understanding of the basic biologic nature of the disease. Residency training in pathologic anatomy is available in the **PATHOLOGIC ANATOMY BRANCH** and, in conjunction with the Clinical Pathology Department of the Clinical Center, a complete residency in pathology is available (see addendum to this catalog).

Cancer research in the clinical branches is primarily oriented toward the disease process in man and frequently is in the form of clinical investigation.

In the **DERMATOLOGY BRANCH**, studies are designed to identify and characterize the biologic behavior patterns of epithelial and lymphoid tissues in normal and pathologic circumstances, using primarily the techniques of biochemistry, electron microscopy, and tissue culture. These studies seek to determine factors that can alter or establish a specific pattern of response of the cell.

In the **ENDOCRINOLOGY BRANCH**, studies of several aspects of endocrine physiology are carried out in normal subjects and in patients with endocrine-responsive tumors. Current research is concentrated in (1) studies of gonadal steroids, secretion and metabolism; (2) studies of protein hormones, with emphasis on gonadotropins and growth hormone; (3) mechanism of steroid action; (4) cytogenetics in patients with developmental abnormalities.

The **ENDOCRINE EVALUATION BRANCH** sponsors studies on endocrine factors in relation to breast cancer. This branch also plays an integral part in the Breast Cancer Task Force activities and its program for study and control of breast cancer.

In the **IMMUNOLOGY BRANCH**, the mechanisms of normal and disordered immune response are under investigation in molecular, cellular, and clinical studies. Physiochemical, immunochemical, tissue culture, isotope incorporation, and *in vivo* turnover techniques are used in research on the structure, biosynthesis, and genetic control of antibodies and immunoglobulins. Investigation of cell recognition systems, cellular antigenicity, and anticell antibodies are parts of transplantation and tumor immunology studies in man and animals.

The **METABOLISM BRANCH** is studying the metabolism of tumors and the effects of tumors upon the metabolism of their hosts. To achieve these objectives, the research program includes studies of the anemia of cancer, porphyrin and bile pigment metabolism, nucleic acid metabolism, calcium metabolism, and the rate of protein synthesis in patients.

Of major interest to the **SURGERY BRANCH** is control, through surgery, of pelvic malignancies, tumors of the head and neck area, skin, bone, and soft tissue tumors, and tumors of the urogenital system. Studies of patients with such malignancies are concentrated in three major areas: primary surgical therapy, various aspects of the host response to cancer, and factors associated with the dissemination of cancer.

Etiology

In the Etiology area, a major responsibility of scientists under the direction of Dr. Carl Baker is planning and implementing programmed research on cancer causation, patterns of cancer occurrence, and means for cancer prevention.

A program of virus-cancer studies is carried out in the VIRAL BIOLOGY, VIRAL LEUKEMIA AND LYMPHOMA, and VIRAL CARCINOGENESIS BRANCHES. Research activities with DNA and RNA viruses in biological systems range from the subcellular level to that of the intact host, including man. A special program is expanding basic and applied research on the possible viral etiology of leukemia. Institute scientists are collaborating with non-Federal investigators in multidisciplinary studies on animal tumor viruses and in the search for viruses in human cancer.

A special program to provide resource needs of cancer virologists, such as standardized cell lines and new varieties of research animals, is also located in the VIRAL CARCINOGENESIS BRANCH.

Chemical hazards in man's environment are of special concern to investigators in the CHEMISTRY and BIOLOGY BRANCHES under the Office of the Associate Scientific Director for Carcinogenesis Studies. Emphasis here is placed on the interaction of host factors with multiple environmental factors.

The EPIDEMIOLOGY BRANCH plans and conducts studies using data from existing sources such as vital and employment records and clinical observations. These investigations seek clues to cancer causation through analysis of interrelationships in the human and domestic animal populations with respect to their total environment and inheritance.

Some of the biostatistical studies carried out by the BIOMETRY BRANCH are also concerned with the causes of cancer. Others are devoted to evaluating methods for diagnosing and treating cancer. In this connection, more than 100 hospitals in the United States are cooperating in a patient registration and followup program.

Chemotherapy

An intensive program of research emphasizing chemotherapy and radiation is under the direction of Dr. C. Gordon Zubrod.

The MEDICINE BRANCH clinical program emphasizes management and improved clinical control of patients with leukemias, lymphomas, and solid tumors. The major effort is in the attempt to achieve tumor cell eradication and cure utilizing new anti-tumor agents, combinations of drugs, and maximum supportive care with platelet and leukocyte transfusions and patient protection ("germ-free" techniques). Research interests include the biochemistry and physiology of normal and leukemic white blood cells, cytogenetics, studies of the immune mechanism in cancer and the effect of drugs and mechanism in action, the kinetics of cell proliferation in neoplasia, methods for the separation and preservation of platelets and white blood cells from whole blood and their use in supportive therapy.

The RADIATION BRANCH concerns itself with the development of new techniques in the treatment of cancer using irradiation alone and in combination with surgery and chemotherapy. Clinical research studies emphasize the management of Hodgkin's disease, other lymphomas, leukemias, and malignancies of the upper air passages.

The LABORATORY OF CHEMICAL PHARMACOLOGY studies the interaction between drugs and living material. Its studies cover many aspects of molecular biology, biochemical pharmacology, and comparative pharmacology and, in addition, the laboratory works closely with the MEDICINE BRANCH on clinical research problems. Examples of some of the current major research projects follow:

- Pharmacology and mechanism of action of DNA and RNA binding antitumor antibiotics.
- Biotransformations and disposition of antitumor agents.
- Mechanisms of exchange between blood, brain, and cerebrospinal fluid in man, laboratory animals, and elasmobranchs.
- Comparative toxicology of antitumor drugs.
- Pharmacology of antitumor and carcinogenic agents in newborn monkeys.
- Clinical pharmacology of new antitumor drugs.

At the BALTIMORE CANCER RESEARCH center in the U.S. Public Health Service Hospital, the National Cancer Institute conducts a collaborative program in cancer research. A clinical therapeutic program is concerned predominantly with evaluation of chemical agents for the control of neoplastic disease. Additional clinical research programs include radiation therapy, a neurosurgical brain tumor program, studies in septic shock, renal functional abnormalities accompanying neoplasms or associated with their treatment, immunologic approaches to cancer control, a program of study and treatment of infectious complication in cancer and leukemia, and blood component replacement therapy. The clinical program is carried out at the USPHS Hospital where there are fully approved residency programs in the major medical specialties. A laboratory program of basic research activities is concerned primarily with pharmacology-oriented investigations with emphasis on lipid and membrane metabolism, drug-enzyme interactions, immunopharmacology and electron microscopy. These areas are fully integrated with on-going clinical pharmacologic studies.

The CANCER CHEMOTHERAPY NATIONAL SERVICE CENTER is engaged in a multidisciplinary approach to the fundamental and developmental aspects of cancer chemotherapy. Through contracts and direct laboratory operations it carries out programs directed toward the development of new and better antitumor agents: The DRUG DEVELOPMENT BRANCH is charged with responsibility for production and formulation of drugs for pharmacologic and clinical studies, and the development of new agents from synthetic and natural sources; the DRUG EVALUATION BRANCH is concerned with the evaluation of such agents in experimental test systems, development of new methods for drug evaluation, and detailed studies of optimal drug dosages and regimens; within the OFFICE OF THE CHIEF, research programs are concerned with establishment of new therapeutic principles, methodologic

studies on the development of new screening systems, studies of drug resistance and mechanism of action, and animal genetics and disease control.

In addition to the research areas described there are many opportunities for those interested in systems analysis and computer programing as related to the data retrieval analysis of this national effort in the PROGRAM ANALYSIS BRANCH.

The CANCER THERAPY EVALUATION BRANCH provides scientific and administrative supervision and coordination for twelve cooperative cancer chemotherapy clinical research groups and four advisory Task Forces. These groups and Task Forces are made up of prominent investigators in the field of cancer research, who participate with the National Cancer Institute in the development and evaluation of effective anticancer therapies. Staff associates maintain liaison between the groups, Task Forces, and the NCI and, in addition, participate in selected research and clinical projects under the guidance of a senior investigator.

National Heart Institute

Robert W. Berliner, M.D., Director of Intramural Research

A. Associate Program in Medicine and Basic Science

The National Heart Institute currently appoints three Research Associates and six Clinical Associates for a 2-year period beginning each July 1. Several Staff Associates are also usually appointed in one or more of the Institute's laboratories. For those who are interested in lengthening their period of research experience, these appointments may, by mutual agreement, usually be extended for a third year.

Candidates may apply for one or more types of Associate positions. In selection of Associates preference is given to candidates who intend to devote a significant portion of their career to research. Because of the diversity of the Heart Institute program, special interest in cardiovascular disease is not an essential requirement.

Research and Clinical Associates

Candidates for Research and Clinical Associate positions have only one interview in the Heart Institute. Each Associate is free to choose his own area of research assignment. After his appointment and prior to his entering on duty, he will make a separate visit, at Institute expense, to select the laboratory in which he will work. The choice is based on the background and interests of the Associate and is contingent only on the ability of the particular laboratory to furnish proper supervision and facilities. (On the basis of past experience, it would appear virtually certain that each Associate will be able to work with the group of his choice.) The level of research responsibility and freedom will depend upon his training and experience as well as his desires.

RESEARCH ASSOCIATES. These appointments are designed to give physicians an opportunity to improve their background for a career in basic medical research. Usually physicians enter the appointment after completing internship and 1 year residency, but there are no specific requirements for postgraduate training after the M.D. degree.

Each Research Associate will devote his time to research in the laboratory under the immediate supervision of a preceptor in an area of his selection. Each will select appropriate courses in the basic, medical and allied sciences, and seminar and journal club exercises common to the program arranged for Research Associates of all the Institutes. No clinical

assignments are involved, but the Associates are welcome to attend any of the clinical teaching exercises.

CLINICAL ASSOCIATES. These appointments are designed to give physicians training in both clinical and basic research. Candidates must have completed a minimum of 1 year of internship plus 1 year of residency in internal medicine by the starting date of their appointment.

Clinical Associates will be responsible, under the guidance of investigators on the Heart Institute staff, for the medical care of patients during 10 of the first 14 months of their service. During this time they will rotate through the 4 medical services of the Heart Institute, which occupy 85 beds. These services include: (1) Cardiology—clinical studies of physiology and pharmacology of the heart; development and application of diagnostic techniques for evaluation of cardiac lesions; selection and pre-operative evaluation of candidates for cardiac surgery; (2) Clinical Endocrinology—metabolic and endocrine problems, including regulation of aldosterone secretion, relationship of steroid structure to activity, calcium and phosphorus metabolism, and application of metabolic balance techniques; (3) Experimental Therapeutics—origin and treatment of hypertension, cardiac arrhythmias, secreting tumors (carcinoid, pheochromocytoma), collagen metabolism, and the biological activities of vasoactive amines; (4) Metabolism, Kidney, and Electrolytes—disorders of lipid metabolism or due to molecular abnormalities of proteins; studies of renal function and action of diuretics.

The clinical period is one of intensive training under direction of the Clinical Director and staff. It offers exposure to case material of an extraordinary range and to highly sophisticated approaches to investigation of disease.

The Clinical Associate devotes both his time off the wards and a full 14 month of his 2-year assignment to laboratory research under direction of a preceptor *in any one of the Heart Institute laboratories, either clinical or nonclinical*. No clinical responsibilities are required during the optional third year. The Associate may also participate in some of the seminars and instruction available to the Research Associate.

Laboratories and Sections

The laboratories and sections of the National Heart Institute, all of which are open to Clinical and Research Associates for their research work, are listed below with the names of their chiefs. Candidates desiring further information may obtain a current bibliography summarizing the activities of the current staff by writing to Dr. Robert W. Berliner, Director of Intramural Research, National Heart Institute, Bethesda, Md. 20014.

Laboratory of Biochemical Genetics—Chief, Dr. Marshall Nirenberg

Laboratory of Biochemistry—Chief, Dr. Earl R. Stadtman

Section on Cellular Physiology—Head, Dr. Wayne Kielley

Section on Enzymes—Head, Dr. Earl R. Stadtman

Laboratory of Chemical Pharmacology—Chief, Dr. Bernard B. Brodie
 Section on Enzyme Drug Interaction—Head, Dr. James R. Gillette
 Section on Organic Chemistry—Head, Dr. Elwood O. Titus
 Section on Pharmacogenetics—Head, Dr. Elliot S. Vesell
 Section on Physiology—Head, Dr. Harriet M. Maling
 Laboratory of Clinical Biochemistry—Chief, Dr. Sidney Udenfriend
 Section on Enzymes and Metabolism—Head, Dr. H. H. Weissbach
 Section on Human Biochemistry—Head, Dr. W. French Anderson
 Section on Physiological Chemistry—Head, Dr. Sidney Udenfriend
 Laboratory of Kidney and Electrolyte Metabolism—Chief, Dr. Jack Orloff
 Section on Renal Mechanisms—Head, Dr. Robert W. Berliner
 Section on Electrolyte Transport—Head, Dr. Jack Orloff
 Laboratory of Metabolism—Chief, Dr. Daniel Steinberg
 Section on Chemistry—Head, Dr. Henry Fales
 Section on Lipid Metabolism—Head, Dr. Daniel Steinberg
 Laboratory of Molecular Diseases—Chief, Dr. Donald S. Fredrickson
 Section on Lipoproteins—Head, Dr. Robert I. Levy
 Section on Molecular Diseases—Head, Dr. Donald S. Fredrickson
 Laboratory of Technical Development—Chief, Dr. Robert Bowman
 Cardiology Branch—Chief, (Vacancy)
 Section on Cardiovascular Diagnosis—Head, Dr. Dean Mason
 Section on Clinical Biophysics—Head, Dr. Donald Fry
 Section on Clinical Physiology—Head, Dr. Stephen Epstein
 Clinical Endocrinology Branch—Chief, Dr. Frederic Bartter
 Experimental Therapeutics Branch—Chief, Dr. Albert Sjoerdsma
 Surgery Branch—Chief, Dr. Andrew G. Morrow

Staff Associates

Several laboratories within the Heart Institute have openings for Staff Associates beginning in July 1969 or July 1970. Applicants should consult the Program Area Selection Check List for the specific openings for which candidates will be interviewed in 1968. Selections for these positions are made by the Chief of the Laboratory.

EXPERIMENTAL THERAPEUTICS BRANCH—A spectrum of research opportunity, ranging from basic biochemistry and pharmacology to study of chemical factors in disease and clinical response to drugs, is offered under the direction of Dr. Albert Sjoerdsma. Current interests include rate-limiting enzymatic reactions, electron transport proteins, collagen, metabolism of vasoactive amines, peptide and steroid hormones, and a variety of drugs.

LABORATORY OF BIOCHEMISTRY—1. Research will be under the direction of Dr. Edward Korn in the Section on Cellular Physiology. The major interests of the laboratory concern various aspects of function, structure and metabolism of the plasma membrane. A combined biochemical and electron microscopic study of lipid transport and of phagocytosis in amoebae are in progress through which it is hoped to learn something of the mechanism of

membrane biosynthesis, the biochemical events of transport, and the molecular events that underlie the gross morphological changes. The amoebae also provide a useful tool for studying certain problems of differentiation of the cell surface. 2. Research will be under the direction of Dr. Elemer Mihalyi in the Section on Cellular Physiology and will be concerned with the structure of fibrinogen. The isolation, characterization of the large fragments of fibrinogen obtained with various proteolytic enzymes will be continued and the relationship of these to clotting and fibrinolysis will be investigated.

LABORATORY OF KIDNEY AND ELECTROLYTE METABOLISM—Research will be under the direction of Dr. Jack Orloff. At present two major areas are under investigation: 1. Mechanism of action of vasopressin and aldosterone on water and electrolyte transport in toad bladder; and 2. electrolyte and water transport in isolated perfused segments of renal tubules *in vitro*.

LABORATORY OF MOLECULAR DISEASES—The positions involve laboratory research and training in biochemistry and metabolism of lipids, proteins, and lipoproteins and exposure to clinical investigations with particular emphasis on genetically-determined disorders of fat transport, under the direction of Dr. Donald S. Fredrickson and staff.

Formal Instruction

The major form of didactic postgraduate instruction is through the evening courses offered by the Graduate Program of the Foundation for Advanced Education in the Sciences, Inc. Research, Clinical, and Staff Associates are expected to take advantage of this academic work.

B. Associate Program in Surgery

The Surgery Branch of the National Heart Institute appoints approximately five Associates in Surgery for a 2-year period beginning each July 1. The program is primarily designed for young surgeons with primary interests in cardiovascular surgery and cardiovascular physiology. In making appointments, preference will be given to candidates contemplating a career in a research or academic atmosphere. Candidates must have completed an internship and at least 1 year of surgical residence by the starting date of their appointment.

Approximately 1 year is devoted to an intensive clinical experience involving the management of patients undergoing operations for congenital and acquired heart disease. During this period the majority of Associates are also trained in the techniques of cardiac catheterization and angiography and in the interpretation of clinical physiologic data. A period of approximately 1 year is also devoted to research in the experimental surgery laboratory and in clinical investigations related to operative procedures. This work, carried out in association with staff members, will be in the general field of cardiovascular physiology as applied to the treatment of surgical patients.

National Institute of Allergy and Infectious Diseases

John R. Seal, M.D., Director of Intramural Research

Sheldon M. Wolff, M.D., Acting Clinical Director

Clinical Associates

The LABORATORY OF CLINICAL INVESTIGATIONS (Sheldon M. Wolff, M.D., Acting Clinical Director)

The National Institute of Allergy and Infectious Diseases will appoint six Clinical Associates. It is to be noted that appointments are made for 3 years. Ward medical care duties occur during the first year, and no assigned clinical responsibilities are made during the second or third year except as dictated by the needs of the Clinical Associates' research. Each Clinical Associate is enabled to select his own area of investigative interest under the general preceptorship of the Clinical Director and his associated staff. Emphasis is placed on the conduct of related laboratory and clinical research designed to provide the basic training necessary for a continuing career in clinical investigations. There are 52 research beds, and laboratory space enables studies on both humans and animal models. Collaboration with investigators in other NIAID laboratories or those of other Institutes is encouraged and Clinical Associates consult on clinical infectious disease problems in other Institutes.

Opportunities for research in a variety of infectious diseases including bacteriological, viral, parasitic, and systemic fungus diseases will continue. A comprehensive program of research on immunological disorders including hypersensitivity states, autoimmune diseases, and transplantation immunology is expected. Opportunities also exist for basic and physiological studies on the pathogenesis of fever and the responsiveness of the human and animal host to a variety of infectious and immunological disorders. Further information can be obtained if inquiries with specific questions are addressed to Dr. Sheldon M. Wolff.

Research Associates

Four Research Associates are to be appointed. The more outstanding candidates among those selected for interviews by laboratories in which they have evidenced interest will also be reviewed by the Director of Intramural Research who makes the final selections and assignments. Candidates are

requested to make a preliminary selection of their laboratory and preceptor but this may be changed at any time before entering on assignment by consultation with the Director of Intramural Research. The laboratories into which Research Associates may be assigned are only those physically located at NIH, Bethesda, Md., as described below.

Staff Associates

Staff Associates are usually not considered for CORD deferment but commence assignment upon completion of their internship. Selection is upon the nomination of the chiefs of laboratories to fill anticipated vacancies in their laboratories. All laboratories listed below are eligible to select Staff Associates and the number varies according to the number of vacancies anticipated.

The **LABORATORY OF VIRAL DISEASES** (Robert J. Huebner, M.D., Chief) encompasses a broad program on the basic biology, ecology, and clinical significance of Viral agents.

Current studies of respiratory agents are concerned with evaluation of the importance of various pleuropneumonia-like organisms in human disease, with means of producing vaccines against many of the more important respiratory viruses, and with studies of rhinoviruses.

In recent years the program of this section has broadened to include studies of tumor viruses, particularly the development of approaches to studies of viral etiology of human cancer.

The **LABORATORY OF BIOLOGY OF VIRUSES** (Norman P. Salzman, Ph. D., Chief) conducts studies relating to the mode of replication of animal and human viruses. Investigations are conducted to define the molecular basis for the pathogenic effects of viruses on cellular functions. These studies are carried out with both lytic and oncogenic viruses. Fundamental biochemical and biophysical studies are also carried out with uninfected cells. The mechanisms by which normal cells are transformed to an oncogenic state are also studied.

Parallel studies to those on viral synthesis seek to define the physical and chemical makeup of the purified virus itself, utilizing electron microscopy, ultracentrifugation, and nucleic acid and protein analysis.

Other programs investigate the isolation and characterization of mutated viruses. Studies are conducted on the relationship between alterations in the viral genome and biochemical alterations in the infectious cycle.

The **LABORATORY OF IMMUNOLOGY** (Dr. John Tobie, Acting Chief) is engaged in a broad program of research covering many aspects of the field of immunology. Fundamental studies are conducted which elucidate the regulatory mechanisms of immunocompetent cells. Investigations concerned with the isolation and purification of transplantation antigen are of special interest. Immunological mechanisms involved in anaphylaxis and other types of immediate allergy, in delayed hypersensitivity and in protection, are investigated at the cellular and subcellular level. Autoimmune diseases

are studied in regard to developmental pathology and relationship to the immune response. Research in immunochemistry is concerned with the study of the chemical and physical properties of antibodies and antigens and the study of their interactions. Special attention is given to the structural basis of genetically controlled antigenic differences among rabbit immunoglobulins and to the control of immunoglobulin heterogeneity.

The LABORATORY OF GERMFREE ANIMAL RESEARCH (John E. Tobie, Ph. D., Chief) is an unusual facility which provides a unique tool, the germfree animal, for the study of the mechanisms of the immune response, the inherent virulence and pathogenicity of microorganisms, and the possible role of microbial associates in disease processes. Basic studies are conducted on the induction and control of immunoglobulin synthesis. Sites of immunoglobulin synthesis are studied in *in vitro* systems and explored by radio-immunoelectrophoresis. Autoimmune diseases, such as allergic thyroiditis, are studied in laboratory animal models and factors which regulate severity and development are elucidated. Antibody responses to various microorganisms are evaluated by the fluorescent antibody technique and immunoglobulins quantitated by gel diffusion methods. By using techniques such as the bentonite adherence method, antibody-forming mechanisms are studied at the cellular level.

The LABORATORY OF PARASITE CHEMOTHERAPY (Geoffrey M. Jeffery, Sc.D., Chief) is concerned with research on the parasitic diseases with particular reference to the development and evaluation of chemotherapeutic methods. Primary emphasis is on malaria and the Laboratory supports a broad investigative program on human, primate and other experimental malarias.

The laboratories at Bethesda are engaged in basic studies on the mode of action of chemotherapeutic agents, on problems of drug resistance, on the development and mechanisms of immunity, and on immunodiagnostic methodology. The activities and properties of promising new drugs are investigated in animal model systems.

The Laboratories at Chamblee, Ga., are primarily concerned with studies on simian malarias, on human malarias in lower primates, and on the vectors of the primate malarias. The investigations include antigenic analysis of parasites by modern immunochemical and physiochemical technics, basic studies on immunology, studies on host-parasite relationships and pathophysiology of the infection, and the effect of chemotherapeutic agents on these responses. Another unit, a related human volunteer program, is located in Atlanta and provides opportunity for study of all aspects of malaria in man. Close cooperation between these two units makes possible the extension of studies in man to the simian host-parasite models.

The LABORATORY OF PARASITIC DISEASES (Paul P. Weinstein, Sc.D., Chief) combines fundamental and applied studies on parasites, parasitism and disease. Current investigations concern: 1. growth and differentiation of helminth and protozoal parasites at the nutritional physiological and bio-

chemical levels; 2. the chemical composition and metabolism of parasites, and the physiologic and biochemical changes in the host that accompany parasitic infection; 3. energy transfer in vertebrate and invertebrate cells, and the correlation of biochemical function with cell structure; 4. intracellular parasitism by *Toxoplasma* and *Besnoitia* with regard to host cell penetration, intracellular multiplication and transformation, and cellular permeability; 5. host specificity for hemoflagellates as influenced by the macromolecular environment; 6. elucidating the parasite-host interactions in schistosomiasis and filariasis that underlie the production of disease and pathology, especially quantitation and duration of infection, reinfection, immunity and hypersensitivity phenomena, and genetics of parasite and host.

The LABORATORY OF MICROBIOLOGY (Roger M. Cole, Ph. D., M.D., Chief) is engaged in basic studies of bacteria and fungi. Streptococci, staphylococci, and a *Hydrogenomonas* are the principal bacterial subjects of current investigation. Areas of study include streptococcal genetics and bacteriophage; the induction and reversion of bacterial L-phase growth and its role in pathogenicity and disease; the role of iron in nonspecific immunity and in bacterial metabolism; bacterial cell walls and autolytic enzymes; the electron transport system of hydrogen utilizing autotrophs; composition, synthesis, and modification of naturally-occurring and synthetic antimicrobial agents; the nature and isolation of some *Mycoplasma* antigens; and ultrastructure of bacteria and other microorganisms.

In medical mycology, utilizing *Histoplasma*, *Coccidioides*, *Candida*, *Cryptococcus*, *Nannizzia*, and *Blastomyces*, there are current studies on physiology and nutrition; effects of experimental chemotherapeutic agents; ecology and interrelationships of soil microflora; genetics of pathogenic fungi; and immunology and immunochemistry of yeast polysaccharides.

The MIDDLE AMERICA RESEARCH UNIT (Karl M. Johnson, M.D., Director) is located in the Panama Canal Zone and is a joint effort of the PHS and the U.S. Army. The Unit is primarily concerned with the etiology and epidemiology of viral diseases in countries of Middle and South America, with emphasis on arboviruses, and with ecology and etiology of selected fungus infections important in the American tropics.

The ROCKY MOUNTAIN LABORATORY (Herbert G. Stoenner, D.V.M., Director) is located at Hamilton, Mont., and enjoys status as a world center for the study and control of diseases in nature transmitted to man. Its principal interests are the biology of animal and arthropod-borne microbiota including the relationship of agents to arthropods, comparative pathology, the relation of viruses and rickettsia to the evolution of chronic disease, the natural history of indigenous agents transmissible to man, and new methods of arthropod taxonomy. The Laboratory also studies the immunological, chemical, and physical properties of microbial antigens and structure and composition

of microorganisms and the relation of cellular constituents to biologic functions.

Additional information on any laboratory may be obtained by writing to Dr. John R. Seal, Director, Intramural Research, National Institute of Allergy and Infectious Diseases, National Institutes of Health, Bethesda, Md. 20014.

National Institute of Arthritis and Metabolic Diseases

J. E. Rall, M.D., Ph. D., Director of Intramural Research

Robert S. Gordon, Jr., M.D., Clinical Director

Clinical Associates

The NIAMD appoints approximately ten Clinical Associates each year. The assignments are for 2 years, and ordinarily are not extended. A limited number of opportunities exist for outstanding Associates to extend their stay for an additional year, or to be considered for appointment to other positions.

Each Clinical Associate is attached for his 2-year duty period to one of the clinical branches or sections, within which he carries out both clinical work and laboratory studies. He is, in effect, an apprentice clinical investigator, working both on the wards and in the laboratory under the guidance of an experienced preceptor. The Associate is encouraged to choose his own problem for independent investigation, subject to the limitation that the facilities required for its successful pursuit, and the technical advice and supervision necessary, must be available to the branch or section in which he is to be working. In addition, he provides professional care for the research patients admitted to the service of his branch chief, and assists in the work of that branch in the outpatient department. There is considerable variation among the branches of NIAMD with respect to the proportion of the Associate's time required for patient care activities.

Since appointments are for 2 years, vacancies do not necessarily occur within each program area each year. The chiefs of branches or sections having openings for new Clinical Associates, and the Clinical Director, screen applications and select candidates for personal interviews. After interviews are completed and the results of matching are announced, each successful candidate is asked to confirm his acceptance of the position with which he was matched. It is not possible, after this, to change the Associate's assignment within NIAMD.

The list below identifies all of the clinical research branches within NIAMD, and their sections, by title and by the name of the chief. The Program Area Selection Check List indicates those having vacancies to be filled at this time. Prospective applicants who are not familiar with the qualifications and research accomplishments of the branch and section chiefs,

or with the details of their current investigative and clinical programs, are encouraged to write Dr. Robert S. Gordon, Clinical Director, NIAMD, Building 10, Room 9N-222, Bethesda, Md. 20014. Supplementary information sheets on each branch, together with selected bibliographic citations, are available on request.

Research Associates

The National Institute of Arthritis and Metabolic Diseases has four positions available each year for Research Associates. These 2-year appointments, usually beginning on July 1, are designed to give highly qualified physicians an opportunity to improve their background for careers in basic medical research. During his stay here, each Research Associate will devote the larger part of his time to participation in laboratory research under the immediate supervision of a preceptor. The chosen candidates are free to choose a preceptor (upon mutual agreement) in any area in the Institute, either clinical or basic research. Should he elect a clinical area, he would not participate in clinical care of patients. The Research Associate, approximately 1 year prior to beginning, will visit NIAMD to select the laboratory and preceptor with whom he wishes to work. Candidates desiring further information about the laboratories, staff and bibliography of NIAMD may obtain this by writing to Dr. J. E. Rall, Director of Intramural Research, NIAMD, National Institutes of Health, Bethesda, Md. 20014.

Staff Associates

A variable number of openings for Staff Associates are available. These positions are for laboratory research under the guidance of a preceptor. Candidates are selected for interviews with the investigator with whom they will work and are appointed for a 2-year period. Those interested in a list of preceptors for this program may write Dr. Rall at the address given above.

Clinical Research Branches

ARTHRITIS AND RHEUMATISM BRANCH—Dr. John L. Decker

Section on Connective Tissue Disease—Drs. John L. Decker, Norman Talal, and Henry Metzger

Section on Human Biochemical Genetics—Dr. J. E. Seegmiller

CLINICAL ENDOCRINOLOGY BRANCH—Dr. Jacob Robbins

Section on Diabetes and Intermediary Metabolism—Dr. Jesse Roth

Section on Endocrine Biochemistry—Drs. Jacob Robbins, Jan Wolff, Hans Cahnmann, Harold Edelhoch, Charles Lewallen, Ira Pastan, Saul Rosen

CLINICAL HEMATOLOGY BRANCH—Dr. N. Raphael Shulman

METABOLIC DISEASES BRANCH—Dr. Robert S. Gordon, Jr.
Section on Gastroenterology—Dr. Leonard Laster
Section on Mineral Metabolism—Dr. Gerald D. Aurbach
Section on Physiology and Clinical Nutrition—Dr. Robert S. Gordon, Jr.
PEDIATRIC METABOLISM BRANCH—Dr. Paul A. diSant'Agnese

Basic Research Laboratories

MATHEMATIC RESEARCH BRANCH—Dr. John Z. Hearon
LABORATORY OF NUTRITION AND ENDOCRINOLOGY—Dr. John C. Keresztesy
Section on Nutritional Biochemistry—Dr. John G. Bieri
Section on Endocrinology—Dr. Robert O. Scow
Section on Vitamin Metabolism—Dr. Bernard Kaufman
LABORATORY OF BIOCHEMISTRY AND METABOLISM—Dr. Gilbert Ashwell
Section on Enzymes and Cellular Biochemistry—Dr. William Jakoby
Section on Intermediary Metabolism—Dr. Yale J. Topper
LABORATORY OF EXPERIMENTAL PATHOLOGY—Dr. Gert L. Laqueur
Section on Histochemistry—Dr. George G. Glenner
Section on Pathologic Anatomy—Dr. Gert L. Laqueur
Section on Biophysical Histology—Dr. Ned Feder
Section on Rheumatic Diseases—Dr. Leon Sokoloff
LABORATORY OF BIOCHEMICAL PHARMACOLOGY—Dr. Herbert Tabor
Section on Pharmacology—Dr. Herbert Tabor
Section on Biochemical Regulation—Vacancy
Section on Biochemistry—Dr. Victor Ginsburg
Section on Biochemistry of Amino Acids—Dr. Simon Black
LABORATORY OF CHEMISTRY—Dr. Bernhard Witkop
Section on Carbohydrates—Dr. Hewitt G. Fletcher, Jr.
Section on Medicinal Chemistry—Dr. Everette L. May
Section on Steroids—Dr. Yoshio Sato
Section on Biochemical Mechanisms—Dr. Louis A. Cohen
Section on Metabolites—Dr. Bernhard Witkop
Section on Microanalytical Services and Instrumentation—Dr. William Alford
LABORATORY OF PHYSICAL BIOLOGY—Dr. John Buck
Section on Comparative Physiology—Dr. John Buck
Section on Molecular Biophysics—Dr. Edwin D. Becker
Section on Electrochemistry and Colloid Physics—Dr. Karl Sollner
Section on Cellular Physics—Dr. Richard J. Podolsky
Section on Physiology—Dr. Paul D. Altland
LABORATORY OF MOLECULAR BIOLOGY—Dr. Gordon M. Tomkins
Section on Metabolic Enzymes—Dr. Gordon M. Tomkins
Section on Chemical Genetics—Dr. Harvey A. Itano
Section on Physical Chemistry—Dr. Gary Felsenfeld

LABORATORY OF MOLECULAR BIOLOGY—Continued

Section on Molecular Structure—Dr. David R. Davies

Section on Microbial Genetics—Dr. Robert Martin

Section on Organic Chemistry—Dr. H. Todd Miles

LABORATORY OF CHEMICAL BIOLOGY—Dr. Christian B. Anfinsen

Section on Biosynthesis and Control—Dr. Robert Goldberger

Section on Genetics and Development—Vacancy

Section on Protein Chemistry—Dr. Christian B. Anfinsen

LABORATORY OF BIOPHYSICAL CHEMISTRY—Dr. Koloman Laki

Section on Bioenergetics—Dr. William J. Bowen

Section on Macromolecules—Dr. Harry A. Saroff

Section on Physical Biochemistry—Dr. Koloman Laki

National Institute of Child Health and Human Development

Gerald D. LaVeck, M.D., Director

Alfred J. Coulombre, Ph. D., Scientific Director

This Institute offers associate training programs in the seven branches indicated below. These programs include activities appropriate to a variety of specialized backgrounds, including obstetrics and gynecology, pediatrics, internal medicine and psychiatry, as well as those with basic science interests including comparative and cellular physiology, biochemistry, biophysics, reproductive physiology, genetics, pharmacology, psychology and developmental biology.

The BEHAVIORAL BIOLOGY BRANCH (Alfred J. Coulombre, Ph. D., Acting Chief) is concerned with biological, neurophysiological, and mathematical modeling, behavioral and cultural-environmental studies of normal, abnormal and pathological aspects of higher-level nervous system functions (learning, memory, intelligence, adaptive capacity, etc.). The long-term goals are to contribute to the creation of biological, behavioral and social methods of enhancement of learning, intelligence, adaptive capacity and other aspects of higher level brain function, as well as methods for identification and elimination of avoidable circumstances which lead to impairment of these functions. The branch seeks to evaluate the biological and environmental factors which facilitate, and those which hinder, intellectual and personal-social development.

The CHILDREN'S DIAGNOSTIC AND STUDY BRANCH (Felix de la Cruz, M.D., Chief) is an outpatient facility where clinical research in biology, medicine, genetics, psychology, learning, speech and hearing, and epidemiology as well as other types of investigations are carried out on children with physical or mental handicaps. Studies are either cross-sectional or longitudinal in nature. A multidisciplinary clinical analysis is made of children who are 6 years old or younger, and who fall under one of the following categories:

1. Those who appear, or have been said, to be developing slowly;
2. Those who appear, or have been diagnosed as, mentally retarded;
3. Those who appear to have, or have been diagnosed as having, learning handicaps or significant communication disorders, and

4. Those who appear, or have been said, to have birth trauma, neurological impairments, or other injury or symptoms which may be related to learning difficulties.

Normal controls, if indicated, are used in our studies. The Clinic utilizes Clinical and Research Associates as well as Staff fellows. Collaborative studies are carried out with other research facilities such as the Behavioral Biology Branch of the National Institute of Child Health and Human Development.

In the DEVELOPMENTAL BIOLOGY BRANCH (Alfred J. Coulombre, Ph. D., Acting Chief) the normal and abnormal development aspects of cellular differentiation, tissue interaction and morphogenesis are investigated with the methods and within the conceptual framework of such disciplines as developmental biology, developmental pharmacology, experimental embryology and the development of behavior. Current studies range from the molecular level (investigations of the role of masked messenger RNA in induction and the developmental phenomenon of "determination") to the level at which normative base lines are established for human menstrual cycling and for the duration of human gestation. Between these two extremes, the brain, the inner ear, and the eye are under intensive experimental analysis to determine the factors responsible for the emergence of orderly patterns during embryonic development.

The multidisciplinary program of the GERONTOLOGY RESEARCH CENTER (Nathan W. Shock, Ph. D., Chief), located on the campus of the Baltimore City Hospitals, offers Clinical (primarily clinical research) and Staff (primarily basic research) Associate training. Preference is given to candidates who intend to pursue careers in investigative and academic medicine. Previous research experience is desirable but not essential to appointment. Appointments for 1970 generally start after 1 year of assistant residency but may start after the internship year.

Special studies on selected diseases are conducted with human subjects and patients in a patient area under Gerontology supervision with the cooperation of the Department of Medicine and other clinical departments of the Baltimore City Hospitals. Community dwelling, active, healthy volunteers age 20 to 100 years offer a remarkable group for longitudinal studies. A 10-bed metabolic balance unit will be available for appropriate studies. Approximately 10 percent of the Associate's time is spent in participating in the examination and care of these subjects and patients. In addition, where indicated, and with appropriate approval, Associates may participate in clinical activities of the Baltimore City Hospitals and the nearby hospitals of the Johns Hopkins University and the University of Maryland. The Baltimore City Hospitals are affiliated with both institutions.

Associates participate in a seminar conducted by the staff of the branch, which presents a comprehensive view of research in Aging. They may participate in a dinner journal club. Weekly research conferences are presented

by members of the staff and invited lecturers. Associates have an opportunity to present their research in this series.

The GERONTOLOGY BRANCH maintains a long-term colony of various species of animals. Animals of specific ages over the entire lifespan of the species are immediately available for approved research projects.

Since appointments are for 2 years, vacancies do not necessarily occur within each program area each year. For further information about any of the sections listed below, candidates are encouraged to write Dr. Reubin Andres, Gerontology Research Center, NICHD, Baltimore City Hospitals, Baltimore, Md. 21224.

BIOPHYSICS—Harry Elden, Ph. D.

CELLULAR AND COMPARATIVE PHYSIOLOGY—Daniel D. Hendley, Ph.D.

ENDOCRINOLOGY—Robert I. Gregerman, M.D.

INTERMEDIARY METABOLISM—Bertram Sacktor, Ph. D.

LONGITUDINAL STUDIES—Nathan W. Shock, Ph. D.

METABOLISM—Reubin Andres, M.D.

MOLECULAR BIOLOGY—Gunther L. Eichhorn, Ph. D.

NUTRITIONAL BIOCHEMISTRY—Charles H. Barrows, Sc. D.

PHYSIOLOGICAL PSYCHOLOGY—Bernard T. Engel, Ph. D.

The LABORATORY OF BIOMEDICAL SCIENCES (Joseph C. Robinson, M.D., Ph. D., Chief) is conducting basic research in genetics, developmental enzymology, intermediary metabolism, and physiological controls. Current topics of interest in genetics are an investigation of the role of extrinsic factors (e.g., viruses and radiant energy) in the production of chromosome abnormalities and a comprehensive analysis of mitosis and meiosis with particular emphasis being given to the cytogenetic correlates of mental retardation and congenital malformations. In the area of developmental enzymology, primary interest centers on the identification and characterization of pregnancy-associated maternal blood plasma enzymes and proteins, the characterization of enzymes synthesized by the placenta, and an analysis of some of the factors involved in enzyme induction within the developing fetus. Investigators in intermediary metabolism are examining the effects of excesses or deficiencies of normal intermediary metabolites, or of secondary metabolites, on cellular differentiation and organogenesis, particularly of the brain. Other research topics in this area of investigation are an analysis of factors affecting the regional distribution of enzymes and metabolites in the brain, an evaluation of the pharmacologic consequences of excesses or deficiencies of metabolites on nervous and mental function, and the development of screening procedures for enzyme defects in mental retardation. In the section on physiological controls emphasis is being placed on hormonal control of metabolism at the cellular and organ levels, the regulation of cell growth as mediated through deoxynucleotide interconversions, and biochemical and physiologic variation.

The REPRODUCTION RESEARCH BRANCH (Roy Hertz, M.D., Chief) conducts an integrated program of clinical and biological studies concerning

human and animal reproduction with emphasis on gonadal development, pubescence, ovulation, fertilization, implantation, menstruation and its disorders, pregnancy and its complications, sterility, and conception control.

Associates participate in basic animal studies or in correlated clinical investigations involving both inpatient and outpatient observation and care.

The SOCIAL AND BEHAVIORAL SCIENCES BRANCH (Leon Yarrow, Ph.D., Child Psychologist) investigates fundamental developmental processes including studies of cognitive, social and personality development, the interrelationships among these functions, and the interactions between social-environmental and biological influences. These studies include: The reciprocal influences in early mother-infant interaction; the development of pro-social behavior during middle childhood and adolescence; the influence of urban and suburban settings on the development of values in adolescents.

Current emphasis is on the earliest periods of development, i.e., the infancy and preschool periods with reference to early environmental influences on cognitive and personality development. Research on infants in "disadvantaged environments" seeks to define the relationships between specific aspects of early mother-infant interaction, e.g., sensory-perceptual stimulation, social-affectional components of maternal behavior and early cognitive and social development. Studies of preschool children, being carried out in Headstart schools and in varied middle class school environments, include several interrelated problems: Development of methods for analyzing the complex learning environments of preschool children; study of the relationship between various classes of teacher behavior, peer interaction, sensory stimulation and changes in cognitive and personality functions; the interrelationships between cognitive and personality functions in preschool children, e.g., the relationship between the growth of language and symbolic functions and the acquisition of impulse controls.

National Institute of Dental Research

Richard C. Greulich, Ph. D., Director for Intramural Research

Harold R. Stanley, D.D.S., Clinical Director

The National Institute of Dental Research conducts a broad program in the biological and physical sciences which are basic to medical and dental problems. Both physicians and dentists are appointed to laboratory as well as clinical areas. Following are brief descriptions of the programs to which Associate appointments may be made.

The LABORATORY OF BIOCHEMISTRY (Karl A. Piez, Ph. D., Chief) conducts programs in basic research covering a broad range of biochemical topics. The laboratory has as its objective the investigation of fundamental biochemical processes in normal and disease states.

Research and Staff Associates are assigned to one of five sections; Protein Chemistry (Karl A. Piez, Ph. D., Chief), Connective Tissue (George R. Martin, Ph. D., Chief), Enzyme Chemistry (John E. Folk, Ph. D., Chief), Cell Biology (Herbert L. Cooper, M.D., Chief), or Teratology (C. T. G. King, Ph. D., Chief). Ample opportunity is provided for interchange and collaboration between sections.

Current research topics include chemical and physical chemical studies on proteins, the chemistry of crosslinks and the determination of amino acid sequences in collagen, the biosynthesis of collagen, elastin and other connective tissue components in animals and in tissue culture, the chemistry and mechanism of action of enzymes, the macromolecular events that occur in the cell prior to and during differentiation, and the pharmacologic action of teratogenic drugs in experimental animals.

The LABORATORY OF MICROBIOLOGY (Henry W. Scherp, Ph. D., Chief) has as its broad objective the elucidation of the microbial ecology of the oral cavity, that is, to understand the interactions of members of the oral microbiota with one another and with the tissues of the host in which they reside, particularly in reference to oral health and disease. Though the Laboratory's programs derive from concern with such diseases as dental caries, periodontal disease, and pathoses of the oral soft tissues, they necessarily include supportive fundamental studies in microbial taxonomy, microbial physiology, immunology, experimental pathology, gnotobiotics, and virology. Cooperative research with other laboratories and branches is conducted as required by the interdisciplinary nature of particular projects.

Current interests of this Laboratory include study of streptococci as specific transmissible agents of dental caries; genetic and dietary influences in

experimental caries of rodents; specific transmissible periodontal pathosis of hamsters caused by a filamentous organism; formation of dental plaque and calculus by oral microorganisms; pathogenesis of experimental infections with oral microorganisms in conventional and germfree animals; allergic reactions of oral mucosa; immunochemical relationships of oral microorganisms; taxonomy of oral actinomycetes, lactobacilli, streptococci, spirochetes, and veillonellae; enzyme regulation pertaining to intermediate metabolism of carbohydrates by oral lactic-acid bacteria.

The IMMUNOLOGY SECTION is primarily involved in studies on the role of immunological mechanisms in oral and systemic disease. Current investigations are concerned with the immunobiological effects of endotoxins and other toxic products of microorganisms implicated in periodontal disease. The role of serum complement and "natural" antibodies in endotoxin-induced inflammation is being explored. Effects of lactic dehydrogenase virus and other adjuvants on immunological tolerance and the mechanism of tolerance at the cellular and subcellular level are being investigated. Studies are being carried out on immunosuppressive agents such as antilymphocyte serum and its mechanism of action in transplantation reactions.

The VIROLOGY SECTION is interested in the factors responsible for recurrent and persistent virus infections; the relationship of viruses to intraoral ulcerations and tumors; chromatography of viruses and infectious nucleic acids; the elevation and catabolism of enzymes in virus infected animals; the effect of virus infections on the hosts' immune system; the kinetics of virus sensitization with antibody and antibody fragments and its role in the maintenance of persistent virus infections; and the mechanism of neutralization of sensitized virus by anti-gamma globulin.

The LABORATORY OF HISTOLOGY AND PATHOLOGY (Marie Nylen, D.D.S., Acting Chief) is concerned with three general research areas—physical biology, histochemistry, and experimental pathology. Although there is considerable overlapping in these activities, assignment of the candidate as well as preceptorial guidance will normally fall into one of these subdivisions.

The studies in physical biology are a broad series of projects concerned with normal and pathologic embryology, anatomy and properties of various mineralizing tissues, basic crystal chemistry of calcium phosphates and related compounds, and the morphological characteristics of whole and fractionated tissue cells, microorganisms and viruses. Opportunities for cooperative research and training are offered in electron microscopy and diffraction, contact and projection microradiography, X-ray diffraction, and infrared absorption spectrophotometry, as well as other standard laboratory techniques.

In histochemistry, investigations are directed toward the determination of the composition and enzymatic activities of normal and diseased mineralized and nonmineralized connective tissues. Standard and experimental histochemical and microchemical methods, both qualitative and quantitative, are employed. At the present time, major emphasis is being directed

to studies of collagenase derived from man, especially from gingivae and bone. These studies include the production, isolation, characterization of the action of collagenase on the collagen molecule, and the relationship of the amount of collagenase produced to various diseases. Considerable effort is also being directed to studies of hyaluronidase and its relation to disease.

The activities in experimental pathology are largely limited to investigation of factors influencing the initiation, transmission and inhibition of dental caries, and periodontal disease. A wide variety of basic animal experiments are conducted as well as clinical trials, as indicated, of promising therapeutic agents and procedures.

The BIOMETRY AND FIELD INVESTIGATIONS BRANCH (Norman W. Littleton, D.D.S., Acting Chief) is concerned with the study of the occurrence of oral diseases in relation to various characteristics of the persons examined, their way of life, and the environment in which they live. Field studies are designed and conducted in an effort to identify, within this dynamic complex, variables which influence favorably or unfavorably the occurrence of disease. The objective of epidemiological study is to provide information that might prove useful in the prevention, control or treatment of disease.

Research activity of the Branch is currently devoted to the epidemiological study of dental caries, periodontal disease, and occlusion. These processes represent by far the three most prevalent problems of oral health. A large-scale study of relationships between nutritional status and oral diseases also is in progress.

Investigations conducted by this Branch have contributed to the understanding of oral diseases in the following areas: The fluoride dental caries relationship, including the caries inhibitory effect of fluoridated water; the development of an acceptable and reliable method for assessing the occurrence of periodontal disease in populations; the high worldwide prevalence of periodontal disease and an appreciation of the major public health problem created by this disease; the close association between the occurrence of dental plaque, calculus deposits, and periodontal disease; and the relationships between nutritional status and oral diseases in various populations.

The ORAL MEDICINE AND SURGERY BRANCH (H. R. Stanley, D.D.S., Acting Chief) provides a backdrop against which clinically-oriented research is undertaken in areas reflecting the varied interests of dental medicine, including clinical and experimental pathology, periodontology, oral oncology, and malocclusion. In addition, two discrete research units have specific focus on problems of broader relevance to biomedical endeavor, generally. These are:

1. The ORAL PHARYNGEAL DEVELOPMENT SECTION (James F. Bosma, M.D., Chief), which is concerned with the development of form and of respiratory and feeding functions in normal and in impaired infants and children. The staff of pediatricians, orthodontists, and speech specialists

collaborates in study and therapy of inpatients and outpatients. Study methods are varied, and commonly include standard and cephalometric radiology, cineradiology, cinephotography, and speech recording and analysis. Particular efforts are made to adapt familiar study techniques and therapies to patients severely handicapped by anomaly or neurological impairment.

Basic investigation is conducted in relevance to clinical problems, including studies of cephalic skeletal growth in a variety of mammals and studies of brain stem mechanisms and motor coordinations of swallow and vocalization.

2. The PROTEIN STRUCTURE AND IMMUNOCHEMISTRY PROJECT (Norman A. Cummings, M.D., Project Leader), which is concerned with the basic structure and properties of proteins, particularly immunoglobulins and dysproteins. Immunochemical, physico-chemical and biochemical techniques are used to study the structure and behavior of the proteins, with some consideration of the possible role of their properties in various connective tissue diseases. Opportunity for clinical study of some of these diseases is available, including Behcet's Syndrome (aphthous stomatitis with multisystem disease).

The HUMAN GENETICS BRANCH (Jerry D. Niswander, D.D.S., Chief) conducts projects in experimental, clinical, and population genetics, with the objective of elucidating the genetic mechanisms in various diseases and normative traits.

These studies utilize a variety of approaches ranging from biochemical, immunochemical, and cytological to mathematical and computer techniques. In addition, clinical skills in both medicine and dentistry are called upon. At the molecular and cellular level, specific studies are concerned with the immune mechanisms, cell growth, biochemical basis of differentiation, cellular handling of genetic information and chemical characterization and genetic control of salivary constituents. More clinically oriented studies involve oro-facial development and malformation, deafness, defects of enamel and dentin, speech and masticatory abnormalities. Population studies of congenital malformations, dental abnormalities and malocclusion, inbreeding effects in isolated populations, inherited hemoglobinopathies, blood groups, taste, and olfaction are in progress.

The PHYSIOLOGY SECTION (Micah I. Krichevsky, Ph. D., Chief) conducts research programs broadly focusing on oral homeostasis and the alteration of these through normal or disease mechanisms. The programs are concerned with experimental exploration of (a) the dynamic interrelationships among environmental factors which alter and/or maintain homeostatic conditions; (b) integrated responses of the organism to its external environment as mediated by the motor or sensory neural system; (c) the detailed nature and metabolic regulatory role of the salivary secretions; (d) techniques for utilizing computer systems in monitoring and regulating the multifactorial parameters involved in the study of oral

dynamics. Experimental approaches derived from the disciplines of biochemistry, computer sciences and electronics play an essential role in these studies.

Specific areas of current research include basic studies on the association areas of cat cerebral cortex and the nature of their responses to stimuli of polysensory origin (e.g., visual, auditory, somato-sensory, etc.); somatic sensation from the oro-facial region as a sensory input testing responses in the trigeminal brainstem nuclei; the growth physiology and metabolic pathways of carbohydrate and phosphate utilization by caries-conducive streptococci; and the use of process-control computers in controlling relevant laboratory experiments.

National Institute of General Medical Sciences

Frederick L. Stone, Ph. D., Director

George J. Cosmides, Ph. D., Coordinator,
Pharmacology-Toxicology Programs

Research Associates in Pharmacology

Program Purpose

Young scientists, as well as more mature investigators in the clinical and basic sciences, will receive 2 years of postdoctoral training in the laboratories of the various Institutes of the National Institutes of Health under the Research Associates in Pharmacology Training Program.

To increase the number of well-trained scientists in pharmacology and related disciplines, this program is designed for:

- those who are interested in pursuing a career in pharmacology and who require basic research training in modern concepts of pharmacology, or
- those who have had experience in research pertaining to pharmacology and who need training in special areas.

The purpose of this training is to develop leaders in pharmacology research for key positions in academic, industrial, and governmental research laboratories.

Training in such areas as applied mathematics, biometrics, organic chemistry, biochemistry, physics, and instrumentation is available to all NIH Associates.

Research Associate applicants indicate their choice of a preceptor who is an NIH scientist. Preceptors also indicate their choice of Research Associates. Preferences are matched and a Selection Committee reviews the qualifications of all applicants for research potential and commitment to research in pharmacology. Under this tutorial system, the Associate will have the opportunity to study fundamental problems related to the basic principles of pharmacology and toxicology.

Program Areas

Choice of program area depends upon the candidate's research interests and previous training. Those who need experience in pharmacology or wish to broaden their experience in biomedical sciences may make their selection from the following program areas:

Biochemical-Physiological Pharmacology

Dr. Julius Axelrod, NIMH (Pharmacology)

Dr. Bernard B. Brodie, NHI (Molecular and Subcellular Pharmacology)

Dr. James R. Gillette, NHI (Enzyme-Drug Interaction)

Dr. David P. Rall, NCI (Chemical Pharmacology)

Dr. Louis Sokoloff, NIMH (Cerebral Metabolism)

Dr. Daniel Steinberg, NHI (Lipid Metabolism)

Dr. Herbert Tabor, NIAMD (Biochemical Pharmacology)

Dr. Elwood O. Titus, NHI (Drug and Transport Mechanism)

Dr. Elliot Vesell, NHI (Pharmacogenetics)

Dr. Eugene Weinbach, NIAID (Drug Action at Subcellular Level)

Clinical Pharmacology

Dr. Irwin J. Kopin, NIMH (Medicine)

Dr. Albert Sjoerdsma, NHI (Experimental Therapeutics)

Those who have already been trained or have conducted research in pharmacology and desire training in some other specialized area of research, may select as a preceptor any senior scientist at NIH, with the approval of the Pharmacology Research Associate Committee.

Types of Appointments

Each year the National Institute of General Medical Sciences appoints approximately 10 Pharmacology Research Associates. At least three of these appointments can be made through the Commissioned Officer Residency Deferment Program.

Candidates for this program may be appointed in a civilian as well as commissioned officer status. Requirements for these appointments are as follows:

PUBLIC HEALTH SERVICE COMMISSIONED CORPS APPOINTMENTS—All applicants must be citizens of the United States. Appointments will be available in two categories: (1) *Commissioned Officer Residency Deferment Program* (CORD)*—See Part Two of this catalog for details. Applicants requiring deferments under the CORD Program, please apply to Chief, Clinical and Professional Education, National Institutes of Health, Bethesda, Md. 20014. (2) *Direct Appointments in Active Reserve*—Appointments are available beginning July 1, 1969. Applicants must have earned a Ph. D., M.D., D.D.S., D.V.M., Sc. D., D. Eng. or equivalent degree. Those found qualified will receive commissions as Public Health Service Officers at ranks determined by training and experience. Apply directly to: Coordinator, Pharmacology-Toxicology Programs, National Institute of General Medical Sciences, Bethesda, Md. 20014.

CIVILIAN STATUS APPOINTMENTS (Beginning July 1, 1969)—United States citizenship and a doctoral degree in a biomedical or related science awarded

* Beginning July 1, 1970.

within the last 5 years preceding the appointment. Applicants with these qualifications should apply to: Coordinator, Pharmacology-Toxicology Programs, National Institute of General Medical Sciences, Bethesda, Md. 20014.

Candidates with more than 5 years of experience or those who have been admitted for permanent residence in the United States at least 1 year prior to making application may also apply for civilian status appointments.

National Institute of Mental Health

John C. Eberhart, Ph. D., Director of Intramural Research

Robert A. Cohen, M.D., Ph. D., Director of Clinical Investigations

This Institute offers an opportunity for post-doctoral research training in psychiatry and in the biological and behavioral sciences. Clinical Associates are usually assigned clinical and research responsibility with approximately one-half time for each endeavor. However, specific arrangements including time allocations, vary in the different Branches and Laboratories. Research Associates engage both in laboratory research and in formal tutorial seminars in biochemistry, pharmacology, neurophysiology, and the behavioral sciences under the preceptorship of one of the senior staff. Staff Associates are engaged primarily in laboratory research under the preceptorship of a senior investigator. Staff Associates may secondarily participate in didactic training as laboratory commitments and personal interests may coincide.

Lectures, seminars, and group discussion by members of the staff and by visiting lecturers complement the training program, making it possible for Associates to acquire a broad background in the neural and behavioral sciences with more intensive and individualized study in selected aspects of the field.

It should be noted that clinical experience in the NIMH emphasizes the opportunity to learn to use a ward and its staff for research purposes as well as for treatment. An opportunity is provided to administer a research ward for the treatment of psychiatric patients emphasizing community oriented milieu therapy and utilizing various patient and patient-family groups as the major therapeutic instruments.

Descriptions of the NIMH program areas to which Associates will be appointed follow.

The ADULT PSYCHIATRY BRANCH (Lyman C. Wynne, M.D., Ph. D., Chief) conducts a broad program of psychiatric research, clinical care, specialized clinical training and research training. Studies are currently being carried out in three main areas; applicants should specify their preferences for one or more of these areas. In all three areas, two or, usually, three years of clinical psychiatric residency training should precede arrival on duty. By special arrangement with a section chief, less residency training may be acceptable. However, ordinarily candidates for Associate appointments in the Adult Psychiatry Branch should apply for the year which is either three

or four years after graduation from medical school (counting 1 year internship and 2–3 years psychiatric residency).

The three branch areas are as follows: (1) Psychosocial Studies—This part of the program is organized in five sections, under Drs. Lyman Wynne, William Pollin, Roger Shapiro, Juliana Franz, Helm Stierlin, Julian Silverman, and Winfield Scott. Currently, clinical work emphasizes family psychotherapy, especially with adolescents and their families. Research projects include studies of links between family communication patterns and the form of psychopathology in offspring; comparisons of families containing schizophrenic versus nonschizophrenic offspring; comparison of genetically identical twins discordant for schizophrenia; attentional, cognitive, psychophysiological, and interpersonal aspects of personality functioning, especially in schizophrenics; problems of the emergence of adolescent identity crises in the family context; the development of cross-culturally standardized methods for the evaluation of schizophrenics; and experimental studies of family interaction.

(2) Psychosomatic Medicine—This section, headed by Dr. William Bunney, conducts treatment and research on affective disorders (including depression, mania, and suicide), focusing on the interface between the psychodynamics of behavior and biological processes (neuroendocrine, biophysical, and biochemical). Intensive longitudinal studies are carried out in patients and animals of behavior in relation to the metabolism of electrolytes, catecholamines, and adrenal cortical hormones.

(3) Psychophysiology of Sleep—Under Dr. Frederick Snyder, this section explores interrelations of physiological and subjective aspects of sleep and dreaming, with the goals of understanding the basic processes in humans and animals and the possible clinical significance of these functions in psychopathological states such as depression and schizophrenia.

The CHILD RESEARCH BRANCH (Richard Q. Bell, Ph. D., Chief) conducts a program of correlated research projects on personality and family development. Longitudinal and cross sectional studies of families living in the community are conducted by an interdisciplinary staff of psychiatrists, psychologists, social workers and teachers. The aim of this program is to define patterns of adaptation and response in newborn infants, preschool children, young married couples and young parents. Congenital infant factors, interpersonal behavior in the family, and personality development are interrelated in the following study areas: (1) Infant Studies—observations of infants in the first few days of life are carried out in local hospitals. Patterns of behavior believed to indicate enduring traits are followed longitudinally through observations in a nursery school laboratory; (2) Longitudinal Family Studies—a number of marriages are followed for several years by means of questionnaires, experimental problem-solving procedures and interviews; (3) Intensive Case Study—selected families are studied more intensively to explore changing interaction patterns. Interaction sequences are recorded on sound film for later analysis; (4) Parent-Infant Studies—interaction patterns be-

tween parents and infants are investigated over the first three months of life. Of central concern are those factors determining the degree and quality of maternal contact. The attributes of the mother and infant are considered in investigating these phenomena.

The **LABORATORY OF CLINICAL SCIENCE** (Philippe V. Cardon, Jr., M.D., Acting Chief. Senior Staff: Dr. Julius Axelrod, Dr. Philippe V. Cardon, Jr., Dr. Jack Durell, Dr. Edward V. Evarts, Dr. Marian W. Kies, Dr. Irwin J. Kopin, and Dr. Louis Sokoloff) conducts a program of research in biochemistry, pharmacology, physiology, medicine, and psychiatry and the interrelationships among them. Current research includes: (1) Mechanism of action and metabolism of drugs and hormones which act in the nervous system, especially catecholamines; (2) thyroxine action on protein synthesis; (3) biochemical studies in endocrine and metabolic disorders and in disease of the autonomic nervous system, including metabolism of amino acids, catecholamines, and other biogenic amines; (4) biochemical studies on myelin; autosensitization reactions in the central nervous system; (5) unit activity in cortical and subcortical areas in relation to sleep and attention; (6) cerebral circulation and metabolism; (7) circulatory physiology and psychosomatic medicine; (8) longitudinal investigation of patients (acute or episodic psychosis, depression) stressing biological factors (endocrine function, catecholamines, serum proteins, specific enzyme activities), and interpersonal factors (dynamics of family interaction, group process, milieu therapy) which vary with clinical course.

The **LABORATORY OF NEUROBIOLOGY** (Ichiji Tasaki, M.D., Chief) conducts research on a variety of excitable cells and tissues, including the brain, using mainly neuroanatomical, neurophysiological, biophysical, and behavioral techniques. This interdisciplinary brain research program seeks an improved understanding of basic neurobiological mechanisms, including those mechanisms underlying perception, learning, memory, judgment and other complex functions. Specifically, studies are carried out on: (1) The physical and biochemical mechanisms underlying electrophysiological events in membranes and synapses; (2) the central controls governing transmission along sensory pathways; and (3) the general principles of integration linking higher sensory and motor pathways in spinal cord, brainstem, and cortex.

The **LABORATORY OF GENERAL AND COMPARATIVE BIOCHEMISTRY** (Giulio L. Cantoni, M.D., Chief) conducts investigations on: Mechanisms and pathways of protein biosynthesis; biological methylations; mechanisms of biological oxidations including oxidation reactions; and alkaloid biosynthesis.

The main focus of the laboratory is on the molecular biology of S-RNA including determination of the base sequence of purified S-RNAs, interaction with messenger RNA and ribosomal particles, biological coding, enzymology of S-RNA, physicochemical studies, etc.

The Section on Cellular Regulatory Mechanisms has a broad program on biological oxidation. The enzymes and coenzymes involved in the oxidation of phenylalanine and DOPamine, are being studied from the point of view of their mechanism, control and biosynthesis.

The Section on Alkaloid Biosynthesis studies the enzymes involved in alkaloid biosynthesis, their control and biosynthesis in relation to morphogenetic development of the plant; also, enzymatic mechanisms of transmethylation and intermediary metabolism of sulfur-containing amino acids in various conditions.

The SECTION ON PHYSICAL CHEMISTRY (Dan F. Bradley, Ph. D., Chief) conducts a program of research focusing on the structure and function of biological polymers. Studies in this general area are carried out using light absorption, fluorescence, optical rotatory dispersion, ultracentrifugation, viscosity, flow birefringence, and dichroism, X-ray diffraction, chromatography, fast reaction kinetics, quantum mechanical calculations, and digital computer techniques.

Current projects include studies on the dye-stacking theory of metachromasia, computer-oriented automation of laboratory procedures, reconstruction of sequences of nucleic acids and proteins, quantum mechanical theory of the optical properties of polymers, protein components of cell membranes, secondary and tertiary structures of polysaccharides, quantum pharmacology and computer simulation of the interactions between biologically important molecules.

The LABORATORY OF NEUROPHYSIOLOGY (Wade H. Marshall, Ph. D., Chief) conducts a program in basic neurophysiology on problems ranging from basic membrane mechanisms to brain and behavior. Current investigations include (1) Brain and behavior with particular emphasis on the limbic system; (2) physiology and biophysics of membrane; (3) physiology of spinal cord; and (4) general neurophysiology of the brain.

The LABORATORY OF PSYCHOLOGY (David Rosenthal, Ph. D., Chief) conducts investigations in seven broad research areas: (1) brain function in primates—cortical mechanisms in sensation and perception in the visual, auditory, and somesthetic systems; cortical mechanisms in problem solving; cortical-subcortical relations in the regulation of behavior; (2) metabolic and cerebral abnormalities in humans—evoked potentials and sensori-perceptual tests in temporal lobe surgery patients, and patients with adrenal insufficiency and with changing serum and total body levels of calcium, magnesium, and lithium; (3) the basic psychology of schizophrenia—etiological studies using identical twins, some pairs concordant and some discordant as to schizophrenia; the nature of stimulus situations and their relationship to autonomic responses; efficiency of performance in problem solving; (4) developmental and comparative psychology—modification of caretaking acts and general environmental conditions and their effects on infant and child behavior; effects of verbal stimulation on development and

intellectual performance in children of low socioeconomic levels; effects of instructions on size constancy in children; concept formation without verbal assistance in preschool children; learning and development of motivation in neonatal dog and guinea pig; (5) perception, thinking, and problem solving—effects of experimental procedures on time estimation in normals and schizophrenics; ways of increasing efficiency of solving complex cognitive problems; (6) communication—units of syntactic encoding and decoding in conversational speech; frequency of body movements as emotional expression; (7) the creative scientist—the role of personality factors in developing and maintaining creativity among potentially creative adolescents and highly creative adults; longitudinal study of the potentially creative sample and study of family relationships which influence creative performance.

National Institute of Neurological Diseases and Blindness

Richard L. Masland, M.D., Director

GENERAL. The National Institute of Neurological Diseases and Blindness conducts, fosters, and coordinates research on the causes, prevention, diagnosis, and treatment of neurological and sensory disorders and related fields, and administers a program of research and training grants and awards.

Throughout the Institute, opportunities also exist for clinical and professional education, including many scientific disciplines.

CORD deferments for approved clinical training beyond a year of internship are available for some Clinical Associate positions in the clinical branches. Research and Staff Associate positions do not provide CORD deferments in this Institute.

Laboratories and Branches

Director of Intramural Research, Henry G. Wagner, M.D.

Clinical Director, Maitland Baldwin, M.D.

Chief, Medical Neurology Branch, W. King Engel, M.D.

Chief, Surgical Neurology Branch, Maitland Baldwin, M.D.

Chief, Ophthalmology Branch, Ludwig von Sallmann, M.D.

Chief, Electroencephalography Branch, Cosimo Ajmone Marsan, M.D.,
Ph. D.

Chief, Laboratory of Neural Control, Karl Frank, Ph. D.

Chief, Laboratory of Neuropathology and Neuroanatomical Sciences,
Igor Klatzo, M.D.

Chief, Laboratory of Neurophysiology, M. G. F. Fuortes, M.D.

Acting Chief, Laboratory of Biophysics, Robert E. Taylor, Ph. D.

Chief, Laboratory of Neurochemistry, Donald B. Tower, M.D., Ph. D.

Chief, Laboratory of Molecular Biology, Ernst Freese, Ph. D.

Chief, Laboratory of Perinatal Physiology, Ronald E. Myers, Ph. D.,
M.D.

Associate Director, Collaborative and Field Research, William F. Caveness, M.D.

Acting Chief, Special Projects Branch, William F. Caveness, M.D.

Special Chronic Diseases Studies, D. Carleton Gajdusek, M.D.

Chief, Epidemiology Branch, Jacob A. Brody, M.D.

Intramural Research Area

The MEDICAL NEUROLOGY BRANCH (W. King Engel, M.D., Chief) has as its major function the application of basic research techniques to the investigation of clinical neurological problems. The Clinical Associate during his tenure becomes acquainted with a majority of the neurological diseases, with particular emphasis on the disorders of muscle, myasthenia gravis, lower motor neuron diseases, metabolic abnormalities of the central nervous system, and genetically determined disorders. He receives instruction in clinical neurology and the related clinical and basic sciences while developing an understanding of the various laboratory techniques which support the neurological investigation. During the 12 months that he is in a ward environment he is responsible for the care of patients on the Medical Neurology Service and the integration of related research. The second year is spent applying one of a variety of basic laboratory techniques (such as histochemistry, tissue culture, biochemistry, immunology, or electromyography) to a clinical problem. The senior Clinical Associates participate in the consulting service.

The SURGICAL NEUROLOGY BRANCH (Maitland Baldwin, M.D., Chief) is concerned with the investigation of epilepsy, involuntary movements, head injury, developmental disorders, brain tumor, cerebral edema, effects of surgical lesions on the nervous system, psychological assessment of surgical lesions, the application of anesthesia to neurological disease states, and problems of hypothermia as related to the nervous system.

The Clinical Associate is required to study and has responsibility for the care of patients with epilepsy, involuntary movements, brain tumors, vascular malformations of the nervous system, and others with a miscellany of neurological disease. He receives practice and instruction in clinical neurology, and, in particular, in the diagnostic techniques of surgical neurology and the operative techniques of neurological surgery as well as the principles on which these techniques are based. He attends clinical rounds in Medical Neurology, staff conferences in electroencephalography and X-ray diagnosis, as well as neuropathological conferences. He is advised to acquire as great a familiarity with the various laboratory techniques as is commensurate with his individual responsibilities and the commitments of the various laboratories in the NINDB.

The OPHTHALMOLOGY BRANCH (Ludwig von Sallmann, M.D., Chief) has clinical programs with the following disease groups: Uveitis, glaucoma, retinal degenerations, vascular retinopathies, tumors of the eye, and cataract.

There are five laboratory sections: (1) Neurophysiology (Head, Dr. M. Fuortes)—fundamental investigations on the mechanism of vision and psychophysical studies; (2) Cell Biology (Acting Head, Dr. P. O'Brien)—studies on amino sugar metabolism and glycoprotein and polysaccharide synthesis in the retina; (3) Pharmacology (Head, Dr. F. Macri)—studies on aqueous dynamics and intraocular pressure; on pressure and perfusate flow

rate in intraocular vessels; (4) Histology and Cytology (Acting Head, Dr. L. von Sallmann)—investigation of ultrafine structures of the eye (Dr. A. Lasansky); cell population dynamics studies on eye tissue; effect of cytotoxic agents on the lens epithelium; (5) Collagen Chemistry (Head, Dr. M. Lewis)—physicochemical studies on collagen of the cornea, sclera, and vitreous body.

The ELECTROENCEPHALOGRAPHY BRANCH (Cosimo Ajmone Marsan, M.D., Chief) involves a relatively small highly specialized patient population from the entire Clinical Center. One Clinical Associate position is available for a 2-year appointment (preference is given to persons with basic neurological training). In neurophysiology one position (Research Associate) is available. Appointment is for 2 years (preference is given to people with some previous experience in the field of electrophysiology and a knowledge of neuroanatomy). Current research: Experimental epilepsy, thalamo-cortical relationship, nature of brain waves, microelectrode study of cortical neurons, etc.

LABORATORY OF NEUROCHEMISTRY (Donald B. Tower, M.D., Ph. D., Chief) directs research toward the elucidation of the chemical attributes of neural tissues which underlie the normal functioning of the nervous system and the derangements of function in various neurological diseases. The investigations, which are primarily at the basic level, are distributed among four sections of the laboratory: the Lipid Chemistry Section (Head, Dr. R. O. Brady), the Enzyme Chemistry Section (Head, Dr. R. W. Albers), the Section on Amino Acids and Electrolytes (Head, Dr. D. B. Tower), and the Physiology and Metabolism Section (Head, Dr. E. G. Trams). In these investigations a wide variety of disciplinary approaches and methodologies, including appropriate clinical material, are being utilized. Special emphasis is given to the relevance of the various laboratory programs to neurophysiological problems, such as mechanisms subserving reception, conduction and transmission of nerve impulses, and to clinical problems, such as the bases for the lipodystrophies, demyelinating diseases, epilepsy, cerebral edema, and nutritional and genetically-determined disorders.

The LABORATORY OF MOLECULAR BIOLOGY (Ernst Freese, Ph. D., Chief) examines chemical alterations of the hereditary material and control mechanisms of enzyme synthesis and differentiation. M.D. or Ph. D. accepted.

(1) The transforming system of *Bacillus subtilis* is used to determine which primary lesions in DNA are induced by different agents and what their ultimate genetic effects are, i.e., DNA inactivation, chromosomal breaks, or different types of mutations. The biological findings are correlated to the chemical and physical analysis of the alterations of nucleotides and DNA.

(2) Bacteria are used as a tool for the study of differentiation. In order to determine the biochemical reactions involved in sporulation and germination, mutants are isolated and characterized structurally, genetically, and

biochemically. The structural analysis utilizes microscopic and electron microscopic techniques. The genetic analysis employs transduction and transformation to determine the location of mutants on the genetic map. The biochemical analysis requires radioactive measurements of RNA synthesis and control, assays of enzymes, thin-layer and gas chromatography, etc. The biochemical pathways involved in development and their control during the commitment period are thus determined.

The LABORATORY OF NEUROPATHOLOGY AND NEUROANATOMICAL SCIENCES (Igor Klatzo, M.D., Chief) recognizes scientific advantages to be derived from close contact and interaction between various approaches used in the fields of neuropathology and neuroanatomical sciences. Thus investigations on basic pathogenic mechanisms operative in various neuropathological conditions are carried out parallel with or supported by studies elucidating structural and functional features of the normal nervous system. Specific problems under current investigation are: Effects of oxygen deprivation, edema, or radiation on the brain, role of the glia, aspects of vascular permeability and transport mechanisms in the brain, mechanisms of neurohormonal regulation, localization of catecholamines, elucidation of some of the sensory and motor systems, investigation on normal structure and pathologic reactions in a primitive nervous system such as that of the Elasmobranchs. The main technical approaches include light and electron microscopy, histochemistry, radioisotopic and biochemical assays. The Laboratory is divided into five sections: (1) The Section of Functional Neuroanatomy, (2) The Section on Experimental Neurology, (3) The Section on Neurocytology, (4) The Section on Experimental Neuropathology, and (5) The Section on Comparative Neuropathology.

Candidates for Research or Staff Associate positions should have research experience under the guidance of an established investigator.

The LABORATORY OF NEUROPHYSIOLOGY (M. G. F. Fuortes, M.D., Chief) conducts research on basic properties of nerve cells and on the organization of the nervous system. *Membrane properties* of receptor cells and central neurones are investigated in vertebrates and invertebrates. Studies of *receptor functions* include analysis of the responses of visual cells to light and investigation of the activity induced in the cochlear nucleus by acoustic stimuli. The properties of *central neurones and synapses* are investigated by recording synaptic potentials evoked by single impulses; by examining the changes of synaptic functions induced by use and disuse and by analyzing the interactions between neurones in ganglia of invertebrates. Studies on the organization of sensory systems deal with the transformations of impulse patterns at different levels of the auditory system of vertebrates and the functional organization between cells in the eye of invertebrates.

The LABORATORY OF BIOPHYSICS (Robert E. Taylor, Ph. D., Acting Chief) activities are centered around basic studies of excitable systems, particularly nerve membranes. At present particular emphasis is placed on electrical

studies of giant axons with replacement of internal contents, mathematical analyses of models of excitable systems, investigations of artificial systems of mono- and biomolecular layers and the synthesis and properties of various organic semiconductors.

The LABORATORY OF NEURAL CONTROL (Karl Frank, Ph. D., Chief) conducts research at applied and basic levels leading to: (1) The development of neural control of external devices, i.e., outward information transfer; through the use of normal and abnormal effector organs; through detection of peripheral motor nerve fiber activity; through detection of activity of other central nervous system neurons. (2) Studies leading to the development of external control of the central nervous system, i.e., inward information transfer; through stimulation of normal and abnormal sensory pathways; through electrodes on sensory nerve pathways; through electrodes in the central nervous system. (3) Research leading to the development of neural modeling for the purpose of studying mechanisms of information processing in the central nervous system.

Applicants for Research or Staff Associate positions in the Laboratory should have special qualifications in neurophysiology, the physical sciences, mathematics, engineering or computer technology. Research experience under the guidance of an established investigator is desirable.

The LABORATORY OF PERINATAL PHYSIOLOGY (R. E. Myers, M.D., Ph. D., and staff), located in San Juan, P.R., functions within the basic neurological disciplines. Areas of specific involvement follow. (1) *Experimental Neuropathology* utilizes biochemical, cardiovascular and descriptive neuropathological approaches to explore problems of anoxic brain damage and cerebral palsy. (2) *Physiological Psychology* is concerned with the identification and characterization of neural mechanisms underlying psychological functions such as perception, memory and learning. This approach includes the application of the modern techniques of electroneurophysiology. (3) *Comparative Neurology* is involved with defining patterns of brain organization using neuroanatomical degeneration techniques. A major focus of attention is upon connectionism of the monkey brain. (4) *Social and Reproductive Behavior*—With the development of experimental enclosure facilities studies will be initiated investigating brain mechanisms underlying social and instinctual behavior. (5) *Primate Ecology*—The unique colonies of free-ranging monkeys on off-shore islands have enabled studies of a broad range, including population dynamics, social behavior, maternal-infant interrelationships, and reproductive activity. (6) *Developmental Neurology*—The availability of large numbers of dated monkey pregnancies within the Laboratory has enabled studies within the broad area of development utilizing techniques of morphology, physiology or biochemistry.

Collaborative and Field Research Area

In this area, the major responsibilities of scientists are planning and carrying out programmed research, particularly in such areas as head injury,

epilepsy, and neurological disorders of childhood, and in epidemiological and biostatistical studies investigating causes and contingent factors affecting the rates of various neurological disorders, including impairments or malfunctioning of sensory disorders.

The SPECIAL CHRONIC DISEASES STUDIES, under the direction of Dr. D. Carleton Gajdusek, comprise the studies of child growth and development and disease patterns in primitive cultures, and the laboratory of slow, latent, and temperate virus infections. Much of the program derives from the study of the disease kuru, which has successfully been transmitted to the chimpanzee. The child growth study involves all aspects of cultural and physical anthropology of native people in relation to their environment, as well as repeated medical, genetic, and microbiological examination of intensively studied groups. Special research films are being prepared on many aspects of these primitive groups.

The HEAD INJURY SECTION, under Dr. Alexander R. Taylor, plans, develops, and conducts investigations of craniocerebral trauma; evaluates and clarifies the current incidence and prevalence of head injuries; determines "state of the art" in the clinical understanding and management of craniocerebral trauma and post-traumatic sequelae; establishing a classification of head injury; appraises methods of epidemiology, prophylaxis, diagnosis, and treatment of head injuries; and launching a multidisciplinary attack on the basic mechanism of head injury in collaboration with laboratories and medical centers on a nationwide basis.

The SECTION ON EPILEPSY, under Dr. J. Kiffin Penry, coordinates a collaborative study of the problem to identify the consequences associated with, or developing from this disorder; evaluates the means and the extent to which the course of the disease can be altered; investigates the role of etiological factors, taken singly and in association with each other; appraises and improves the definition and classification of the disorder; along with these studies conducts research to improve diagnostic and therapeutic techniques.

The EPIDEMIOLOGY BRANCH, under Dr. Jacob Brody, comprises the main branch with its laboratory facilities, a Section on Ophthalmic Field and Developmental Research, a Section on Genetics in Epidemiology, and a research center in Guam. Diseases being studied epidemiologically include multiple sclerosis, neurological syndromes and lung cancer, measles and subsequent neurological and psychological abnormalities, and amyotrophic lateral sclerosis. Major effort in genetics has been a study of dystonia musculorum deformans. Studies on Guam include ALS and PD, including epidemiological and genetic patterns and clinical and neuropathological studies. The Section on Ophthalmic Field and Development Research has established a register of twins residing in the Washington area and has begun ocular evaluations and zygosity determinations. These studies are being expanded in cooperative twin registers in other population centers.

The PERINATAL RESEARCH BRANCH (Heinz Berendes, M.D., Chief) directs a program of research concerned with the correlation of factors operating in pregnancy to cerebral palsy, mental retardation and other neurological and sensory disorders of infancy and childhood, and in its own laboratories conducts intensive studies in infectious diseases in pregnancy, using both human and animal populations, and in neuropathology directed primarily to field studies to determine causative factors of brain damage.

The PERINATAL RESEARCH BRANCH'S SECTION ON INFECTIOUS DISEASES (John L. Sever, M.D., Head) (1) develops and utilizes large-scale serological methods to study the relation between viral, protozoal, bacterial infections, and birth defects and related abnormalities; (2) conducts investigations on viruses, protozoa, and bacteria, to produce antisera to these agents and to determine the effects of these microorganisms on the animals and fetal tissues; (3) investigates recovery of infectious agents and chromosome changes in fetal tissue specimens; (4) studies the effects of specially selected viruses on human volunteers and other populations to determine their pathogenicity.

The OFFICE OF BIOMETRY, newly established under the Office of the Director, NINDB, Dr. Richard L. Masland, provides mathematical and statistical advice and assistance to the staff and program areas within the Institute. This Office is composed of the Office of the Chief and four sections:

(1) Section on Mathematical Statistics—provides consultation and service in mathematics and mathematical statistics in the design, analysis and interpretation of experiments.

(2) Section on Applied Statistics—assists in program formulation in collaborative prospective investigations and studies including the development of protocols and the establishment of statistical quality control procedures.

(3) Section on Systems Design and Data Processing—development of policy and procedures for data collection, storage and retrieval. Construction of systems designs and specifications for specific studies.

(4) Section on Blindness Statistics—plans, develops and implements the program to collect, analyze and publish statistical data on blindness disability derived from national and international sources.

Division of Biologics Standards

Roderick Murray, M.D., Director

The Division of Biologics Standards is accepting applications for Staff Associateships in the Laboratory of Bacterial Products, Laboratory of Pathology, Laboratory of Viral Immunology, and Laboratory of Virology and Rickettsiology. Appointments will become effective July 1, 1969 or July 1, 1970, depending on the ability of the laboratories to accept candidates at each time and on the candidates' desires for deferment.

The LABORATORY OF BACTERIAL PRODUCTS (Margaret Pittman, Ph.D., Chief) is engaged in a diversified program of basic and applied research in microbiology and immunology on bacterial vaccines, toxins, and allergens. Emphasis is placed on nature of protective immunological responses, hypersensitivity and toxic reactions and immunochemistry of sensitizing antigens. Preference is given to applicants with pediatric and allergological interest in immunology and hypersensitivity.

The LABORATORY OF PATHOLOGY (Ruth L. Kirschstein, M.D., Chief) is engaged in a program of research in the pathogenesis of infectious diseases, hypersensitivity and immunologic responses with special emphasis on oncogenic viruses and those infectious agents for which there are vaccines and/or other methods of prevention. Animal models of infectious diseases or tumor-producing systems are studied as to the mode of transmission within the colony, spread within each animal, and the final pathologic changes that occur.

Staff Associates will receive extensive training in the pathology of various infectious diseases and animal tumors using the wealth of material accumulated in the last 10 years. In addition, there are opportunities to develop individual research projects in the area of infectious diseases and oncogenesis. Persons interested in such an assignment should have a broad interest in medicine and/or pathology.

The LABORATORY OF VIRAL IMMUNOLOGY (Harry M. Meyer, Jr., M.D., Chief) and THE LABORATORY OF VIROLOGY AND RICKETTSIOLOGY (Alexis Shelokov, M.D., Chief) are engaged in programs of virus research with special emphasis on the study of viruses of current or potential importance in the biologics field. Although each laboratory participates in clinical trials of vaccines on occasion, individuals should anticipate spending all or most of their time in laboratory research. Each Staff Associate works under the guidance of a senior member of the professional staff. Projects vary from

basic to applied research depending on the interests of the individual and the needs of the Division. Assignment of these laboratories offers the opportunity to acquire a foundation in laboratory virology and for this reason would be most valuable to physicians planning academic careers in infectious diseases or related fields. The above laboratories give preference to applicants with 1 or more years of residency training in pediatrics or medicine, but do not require prior experience in virology.

Clinical Center

Jack Masur, M.D., Director

Robert M. Farrier, M.D., Associate Director

Roger L. Black, M.D., Associate Director

The Clinical Center appoints Clinical Associates for the Departments of Anesthesiology, Diagnostic Radiology, Blood Bank, and Nuclear Medicine. Associates in Anesthesiology and Diagnostic Radiology are expected to have completed their residences prior to entrance on duty. Applicants for these positions will be selected directly by the department chiefs without recourse to the matching of candidate and program-area preferences. The Blood Bank Department requires only 1 year of residency training.

The ANESTHESIOLOGY DEPARTMENT (Clarence L. Hebert, M.D., Chief) offers advanced training—through the Associate program—to medical graduates who have fulfilled residency requirements of the American Board of Anesthesiology, and who have special interest in research. (Senior residents from other hospitals are accepted for brief periods for special training. Arrangements for such assignments must be made well in advance by the director of the residency program.)

The Anesthesiology Department is organized as a central service to provide anesthesiological care for all patients hospitalized at the Clinical Center, NIH. Inhalation therapy and consultative services for special problems (respiratory, pain, etc.) are included.

Four of the National Institutes of Health have surgical services which have active programs in surgical research.

The National Cancer Institute (Surgery Branch) has a long-range program concerned with the performance of extensive radical surgery with special emphasis on the treatment of patients with malignancy of pelvic organs and structures of the head and neck. In addition, various types of other general surgery are done on NCI patients and those patients sponsored by other Institutes, who require surgery during their Clinical Center stay.

The National Heart Institute admits patients for the study and treatment of congenital and acquired heart disease. All types of cardiac surgery are performed, the majority consisting of open-heart operations performed with the aid of extracorporeal circulation. Six or more of these operations are done weekly.

The National Institute of Neurological Diseases and Blindness has several surgical programs including: Ophthalmological surgery; localization and

surgical removal of epileptogenic foci within the temporal lobe for the treatment of epilepsy; stereotaxic procedures for the relief of syndromes characterized by abnormal movements and rigidity; and the removal of malignant lesions of the brain with the aid of generalized hypothermia.

The National Institute of Dental Research sponsors a project for the detailed study of physiological variables in ambulatory dental patients undergoing oral surgery under general anesthesia. Various anesthetic agents and techniques are employed in the study. Currently, this study is concerned with the risks involved and the effect of patient position on performance of surgery and patient safety.

The clinical workload is relatively light, with the number of anesthetics averaging about 140 per month. Time is available for anesthesiologists who wish to spend time in laboratory investigational work. One day per week is allotted for laboratory work, and additional time is usually available. The animal laboratory facilities of the NHI and the NINDB are available to our staff. Advice and assistance from senior investigators, including outside consultants, can be obtained.

An Anesthesia Research Laboratory is operated as a joint project by the Surgery Branch of the National Heart Institute and the Anesthesiology Department of the Clinical Center.

The Anesthesiology Department staff is comprised of eight full-time anesthesiologists, three nurse anesthetists, three anesthesia technicians, five inhalation therapists, two extracorporeal apparatus technicians, and two secretaries. Visiting anesthesiologists from foreign countries may also be appointed for 1-year periods.

The DEPARTMENT OF DIAGNOSTIC RADIOLOGY (Betty E. Hathaway, M.D., Chief) offers a 2-year Clinical Associate program of experience in all phases of diagnostic radiology and advanced training in special study procedures which include: Angiocardiology; femoral arteriography; selective celiac and renal arteriography; inferior venocavography; lymphangiography; carotid and vertebral arteriography; bronchial arteriography; pneumoencephalography and ventriculography; retroperitoneal air studies; sialography; and gynecography.

The department provides complete diagnostic X-ray services for all of the patients from seven Institutes. The clinical material studied radiographically is most unusual and many opportunities are available for clinical research.

Approximately 40,000 X-ray examinations are performed annually on 25,000 patients including 2,000 special study procedures.

The department staff is composed of 10 full-time radiologists, 19 X-ray technicians, 2 nurses, and 16 accessory personnel.

The professional and physical environment is excellent and close liaison is maintained with the Radiation Therapy Department, the Department of Nuclear Medicine, and the radiology departments of all local hospitals.

The BLOOD BANK DEPARTMENT (Paul J. Schmidt, M.D., Chief) is accepting applications for Clinical Associateships under the matching system.

Preference will be given to applicants with 1 or more years of residency training in clinical laboratory medicine.

The Department is engaged in a program involving basic and clinical study of blood components of the *in vivo* effects of biologic incompatibility, of mechanisms of the alteration of cellular antigens by disease states and of transplantation.

The Clinical Center Blood Bank supplies some 20,000 perishable blood products annually for transfusion to patients with unique hematological and immunological problems. Many opportunities are available for collaborative basic and clinical research. Close professional liaison is maintained with the Clinical Pathology Department.

The program offers training for the internist or pediatrician in the careful laboratory control of a patient-oriented transfusion program as well as advanced training for the clinical pathologist.

THE DEPARTMENT OF NUCLEAR MEDICINE (Jack D. Davidson, M.D., Chief)

Beginning in 1967 this department will accept one Clinical Associate for a 2-year period of training in all aspects of Nuclear Medicine, including limited experience in the therapeutic uses of radioisotopes. Time will be spent among the department's three sections as well as time available for experience in the Clinical Center Radiopharmacy in which three full-time pharmacists are available for teaching.

The program provides the opportunity to engage in limited research in cooperation with the several Institutes at NIH.

Preference will be given to those applicants with training and background in radioisotopes. The specific field of previous residency training is not a primary consideration.

The Department of Nuclear Medicine was established as a centralized service to provide all currently available isotope procedures for Clinical Center patients and NIH laboratory investigators.

The Diagnostic Radioisotope Service performs over 3,000 scintillation scans a year utilizing a wide variety of radiopharmaceuticals. Routine dynamic function studies are also performed as well as experimental studies in conjunction with investigators from other institutes.

The Radiation Safety Section provides a wide variety of services, including the assay of all radioisotopes for human use. Other responsibilities include accounting for the 50 curies of radioisotopes received and disposed of each year at NIH, performing calibration and safety checks on the 123 X-ray machines and 277 sealed sources at NIH, and evaluating over 12,000 film-monitoring badges a year.

The whole Body Counting Section provides a consultation service to all Institutes and is engaged in basic research on trace quantities of radioactivity, personnel monitoring, and a variety of clinical studies.

Division of Environmental Health Sciences

Paul Kotin, M.D., Director

William W. Payne, Sc. D., Deputy Director

Hans L. Falk, Ph. D., Associate Director of Laboratory Research

The Division is responsible for defining, quantifying, and understanding the biological effects of chemical, physical, and biological hazards in man's environment for the purpose of contributing scientific knowledge for the evaluation of health hazards from these sources and for decisions with respect to their control or amelioration.

The headquarters and intramural research programs of the Division are located at the National Environmental Health Sciences Center in Research Triangle Park, North Carolina. A close working relationship has been established with the universities in the Triangle area—University of North Carolina at Chapel Hill, Duke University at Durham, and North Carolina State University at Raleigh. This relationship affords the staff access to extensive library facilities as well as opportunities to participate in seminars and other scientific and professional activities associated with the universities.

The center of the scientific interest of the Division is the phenomena associated with the source, distribution, mode of entry, and effect of adventitious chemical and biological substances upon biological systems in relation to the health and well being of human beings. The area of inquiry encompasses the epidemiology of environmental hazards, the dynamics, reaction kinetics, and modes of transmission and entry of such substances; the short and long-term toxicological and morphological effects upon biological systems, both animal and man. The objectives of this inquiry are to assess the actual and potential risks associated with exposure to adventitious environmental hazards; to determine tolerances and threshold of hazard to biological systems as a guide for control policies, and to elucidate mechanisms and mode of action as a basis for the development of control technology.

The research program requires both fundamental and applied research using a wide variety of scientific disciplines, including physical sciences, chemistry, pathology, general biological sciences, biometry, epidemiology and clinical sciences.

Staff Associates will work at the National Environmental Health Sciences Center under the direction of Dr. Paul Kotin and Dr. Hans Falk. Each Associate will work directly under a senior scientist in the area of research chosen by the Associate.

PART FOUR

Academic Programs Available to Associates

AMONG the academic programs open to an NIH Associate are: Evening courses provided by the Foundation for Advanced Education in the Sciences, Inc.; formal Seminars under the direction of NIH staff; Combined Clinical Staff Conferences; formal lectures; symposia; and an annual scientific equipment exhibit. The "N.I.H. Calendar of Events" lists an average of 15 to 20 programs each week. Other events of interest are held at universities and other institutions in the Washington-Baltimore area.

Evening Courses

Evening courses are provided by the Graduate Program of the Foundation for Advanced Education in the Sciences, Inc. Established by scientists who subscribe to the view that learning, research, and teaching are mutually reinforcing processes essential to the evolution of science, the Foundation is a non-Federal independent organization as defined by the Government Employees Training Act; however, its tuition and other fees can be paid by a Federal employer. Courses are offered in two semesters, fall and spring; courses are offered at the undergraduate and graduate levels under the programs of its several Departments of instruction: Behavioral and social sciences, biochemistry, chemistry, genetics, mathematics, statistics, physics, medicine and physiology, microbiology and immunology, languages, and general studies. Further inquiries regarding the Graduate Program and requests for its current catalog should be directed to: Registrar, Foundation

Seminars

An NIH Program of formal tutorial seminars and informal discussion groups is designed in content and emphasis for prospective independent investigators, and gives them the additional opportunity to master selected topics not adequately covered during college or graduate schooling. These exercises are an integral part of the Associate Program and are geared specifically in that direction. The program accommodates Research, Staff, and Clinical Associates and other properly qualified persons. The tutorial seminars made available during the Academic Year 1967-68 are listed below.

(1) Biochemistry and genetics: (fall)—Carbohydrates and modern biology, enzyme mechanisms in relation to protein structure, protein structure-function (and model building), selected topics in mammalian genetics. (spring)—Biological control mechanisms, mechanisms of action and structure of protein hormones, nucleic acids and the chemical basis of genetics.

(2) Mathematics and physical chemistry: Applied data analysis and model building (fall and spring), thermodynamics (fall), physical chemistry of proteins (spring).

(3) Cell biology, physiology and immunology: (fall)—Selected topics in immunology, transport across non-excitabile membranes (fall and spring), ultrastructural aspects of cell biology. (spring)—Cellular differentiation, chemistry and physiology of muscle, topics in integrative neurophysiology, and three seminars in immunology and immunochemistry.

Weekly seminars run from September through January and from February through June. Each session is of 2 to 3 hours' duration, and the participants present specific material under the direction of a qualified expert in the field. In preparation for these, the Associate does appropriate outside reading.

Combined Clinical Staff Conferences and Lectureships

Aside from the rounds and staff conferences within the separate institutes engaged in clinical research, the Clinical Center sponsors at least one monthly Combined Clinical Staff Conference for 9 months of the year. Each conference is conducted by one of the Institute services or an appropriate Department of the Clinical Center. This series of conferences is complemented by Grand Rounds and Clinical Pathological Conferences which, in effect, serve the same purpose. The conferences—open to the entire clinical staff and those engaged in laboratory research as well—center around clinical case material having interest for a large portion of the staff, and serve to keep individual investigators abreast of current emphasis in all clinical research.

Several formal lectures are presented annually. The National Institutes of Health Lecture Series was established in 1953 to recognize outstanding scientific accomplishment and to contribute to the interchange of scientific information. The lectureships are awarded by the Director of NIH on the advice of the Scientific Directors of the Institutes. The R. E. Dyer Lecture-ship was established in 1950 by friends and colleagues of Dr. Rolla E. Dyer, Director of the National Institutes of Health, 1942–50, to pay him tribute upon the occasion of his retirement from the Public Health Service. The award is made at appropriate times—usually on an annual basis—to a scientist who has made an outstanding contribution to knowledge in a field of medical science; and is administered by NIH.

The Jules Freund lecture series was established in 1961 and is presented annually in honor of the first Chief of the Laboratory of Immunology, National Institute of Allergy and Infectious Diseases.

Equipment Exhibit; Symposia

The NIH Research Equipment Exhibit was established in 1951 to acquaint scientists with the most modern research tools and to give them an opportunity to discuss equipment problems with representatives of industry. In 1954, a Symposium on Recent Developments in Research Methods and Instrumentation was added, offering a balanced presentation by specialists in many areas of biomedical research. The two annual events combine to provide a convenient setting for the exchange of information between research investigators and manufacturers of scientific equipment.

The NIH International Symposium on Biomedical Research was established in 1963 to emphasize the mutuality of interest of NIH and the international scientific community, particularly with the extension of NIH programs overseas.

The Washington-Baltimore Educational Complex

The Washington-Baltimore area is widely known for its educational advantages. For example, three medical schools (Howard, Georgetown, and George Washington) are located in the District of Columbia and two (Johns Hopkins and the University of Maryland) are in Baltimore. These and the universities with which they are associated, together with unique institutions such as the Armed Forces Institute of Pathology and the Naval Medical Center, offer exceptional opportunities. Some Associates find the time to pursue a certain amount of formal education at such nearby institutions.

Library Facilities

The National Institutes of Health Library (located in the Clinical Center) provides a central facility for all scientists, technicians, administrators, and supporting staff who are engaged in the research program. As a self-service, open-stack library, it contains a collection of 90,000 volumes and receives 4,500 monographs and 2,800 foreign and domestic journals. Its translation service and the proficiency of its staff in compiling bibliographies are noteworthy.

The National Library of Medicine is located on the NIH campus. While this library serves the entire country, its proximity makes it especially valuable to NIH investigators. Holdings exceed 1 million items—books, journals, theses, pamphlets, prints, and microfilm. Researchers may consult material at the Library and may request printed material through the NIH inter-library loan service.

Addendum—Residencies

Fully approved residency programs are offered in clinical pathology, anatomical pathology, combined clinical and anatomical pathology, and oral pathology. Requests for information and application forms regarding these programs should be addressed to the respective program chiefs:

George Z. Williams, M.D.
Chief, Clinical Pathology Department
Clinical Center
National Institutes of Health
Bethesda, Md. 20014

Harold L. Stewart, M.D.
Chief, Pathological Anatomy
Clinical Center
National Institutes of Health
Bethesda, Md. 20014

Harold R. Stanley, D.D.S.
Acting Chief of Oral Medicine and Surgery
National Institute of Dental Research
National Institutes of Health
Bethesda, Md. 20014

On the basis of agreements between program chiefs and appropriate American Speciality Boards, Clinical Associates in dermatology, psychiatry, and neurology may receive credit for 1 year each. Associates in internal medicine who remain at NIH for a third year may receive credit for this year upon application to the American Board of Internal Medicine.

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